DECEMBER, 1954 — SIXTY-FIRST YEAR

MACHINERY

"The Outstanding Tool Room Lathe"

HARDINGE Model HLV
TOOL ROOM LATHE

The machine preferred for precise collet, step chuck and jaw chuck work

See Page 152

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Greenfield, Mass.

and

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New Haven 15, Conn.

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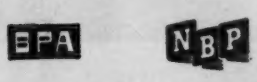

MACHINERY

VOLUME 61 DECEMBER, 1954 NUMBER 4

The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

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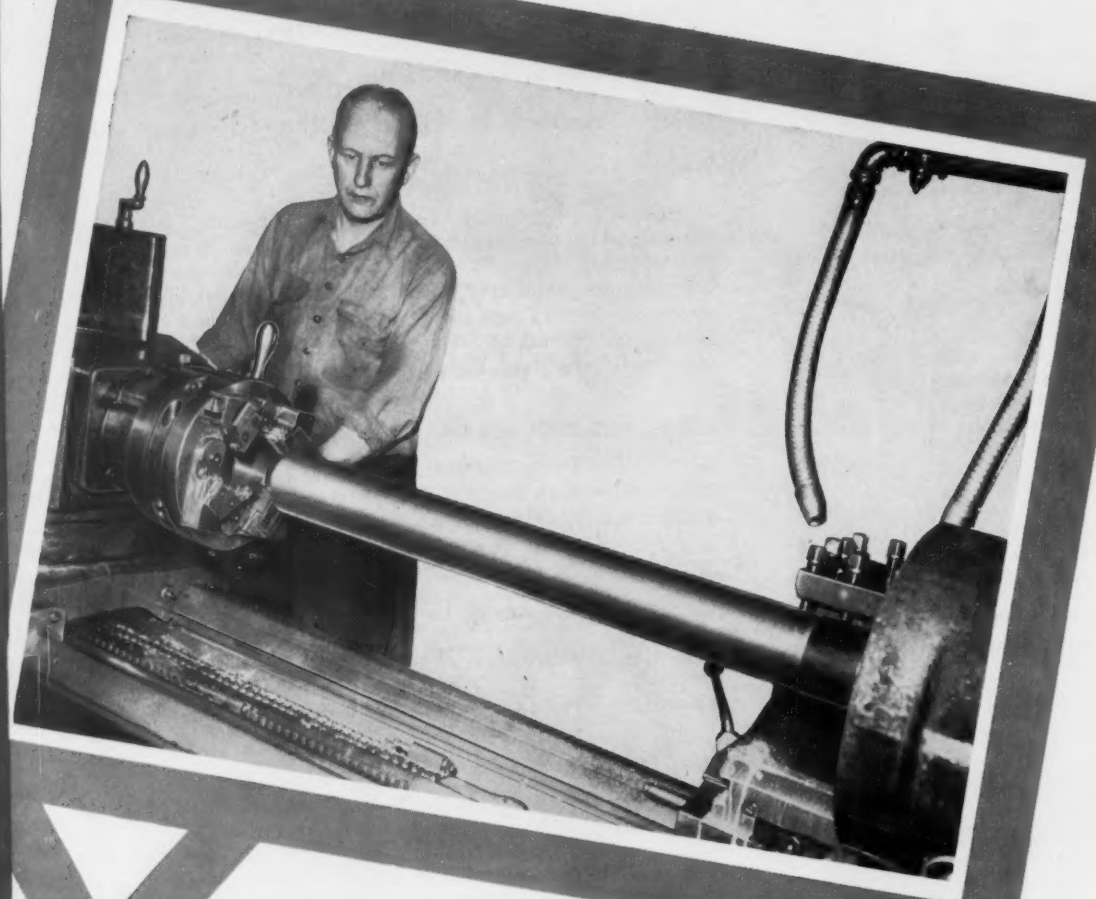
THE WORLD'S LARGEST MANUFACTURERS OF THREADING EQUIPMENT - CUTTING - TAPPING - GRINDING - ROLLING



2—MACHINERY, December, 1954

3¼" 8P threads–29" long with LANDMATIC 32AX Head

4150 steel heat-treated to 28-32 Rockwell "C" is threaded to a Class 3 fit by a LANDMATIC 32 AX Head. Rugged tangential chasers provide long life and allow threading after heat treating. Special centering throats on these chasers eliminate the out-of-round condition common in long workpieces.

This stationery self-opening head is used on a 3A Warner & Swasey turret lathe to thread tie bars for plastic injection molding machines at the Reed Prentice Corp., Worcester, Mass.

The 32AX LANDMATIC Head will thread workpieces up to 4" in diameter through the bore, and cut 8 pitch or finer threads up to any practical length. By using oversize chaser holders short lengths of threads can be cut on larger workpieces up to 6¼" in diameter. A larger head, the 40AX, features a six-chaser design to give greater distribution of cut and greater support to large diameter workpieces. This head will cut threads up to a maximum of 9¼" in diameter with the same pitch limitations.

☆ ☆ ☆

For more information on the 32AX LANDMATIC Head, send specifications and ask for Bulletin No. F-90.

LANDIS Machine COMPANY
WAYNESBORO · PENNSYLVANIA · U. S. A.

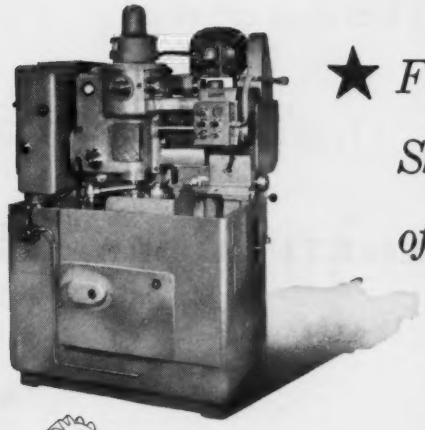
405-2C

So Fast you may wish

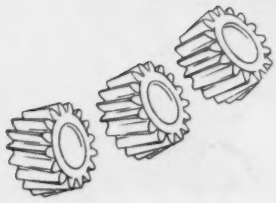
Shown above is the No. 4 GS Gear Shaper equipped for fully automatic loading, cutting and unloading.

THE *Fellows*

to use MAGAZINE FEED!



★ *Fellows New No. 4 GS Gear Shaper ideal for mass output of automotive pinions.*



Rotary feeds of .008" to .024" per stroke of a 4 inch cutter with a husky drive mechanism operating a 3⅜" diameter cutter spindle at speeds ranging from 98 to 635 strokes per minute make the No. 4 GS Gear Shaper a high production machine for gears up to 6" pitch diameter and 2" face width.

To utilize its production speed to the greatest advantage in the smaller size range, the No. 4 GS is designed to facilitate the addition of work magazines or other work loading and unloading devices. Automatic feed production rate for 1-1/16" diameter x ⅝" face width automotive pinions is 1 per minute. Blanks are (1) fed from a feeding device down a chute to the magazine slide, (2) automatically located and clamped on an expanding arbor, (3) cut, (4) automatically lifted off the arbor and (5) ejected into the unloading chute.

It's a production man's machine–standard or automatic. Fellows Sales Engineers will be glad to tell you all about it. Address the nearest Fellows office.

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Introducing the New CINCINNATI TOOLMASTER

Style 1C Toolmaster Milling Machine. Equipped with 2 hp heavy duty spindle head; built-in motor; 8 spindle speeds; No. 40 standard spindle nose.

MILLING MACHINE

Style 1B Toolmaster Milling Machine. Cincinnati rectangular overarm, square gibbed saddle-knee bearing, extra wide knee bearing on column face . . . these and other features constitute exceptionally sturdy construction for maximum hp cuts.

Meet the newest member of Cincinnati Milling's extensive line of machine tools . . . the Toolmaster. There are three styles of these sturdy toolroom milling machines:

1A — Manual feed to quill
1B — Power feed to quill
1C — Heavy duty spindle head

Style 1B Toolmaster Milling Machine. Equipped with 1 hp spindle head; collet chuck type spindle nose, capacity ⅛" to 1" shank cutters; power feed to quill; worm positioning of swivel head.

Toolmaster Milling Machines constitute a new opportunity to reduce costs in shops of all sizes; in toolrooms, metal pattern shops, contract machine shops, tool and die shops. You can depend upon any machine tool bearing the name plate of The Cincinnati Milling Machine Co. Would you like to know more about this new Toolmaster? Write for new four-color catalog, No. M-1870.

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

CINCINNATI

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FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

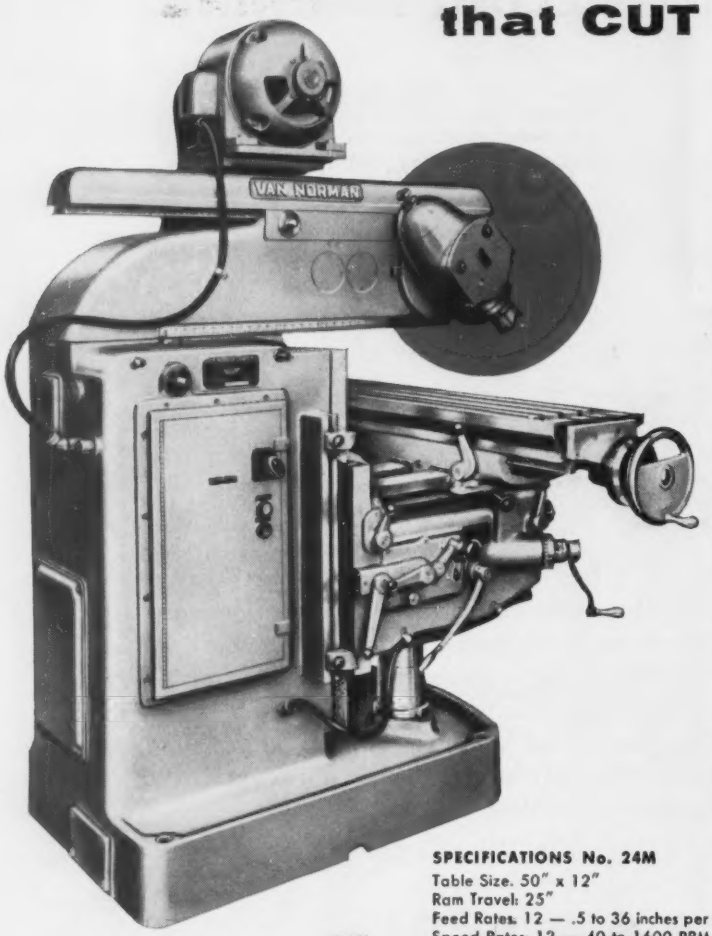
...the NEW

VAN NORMAN Ram-Type Millers

give you the advantages of

EXTRA FLEX-ABILITY and CUT-ABILITY

that CUT milling costs



SPECIFICATIONS No. 24M
Table Size. 50" x 12"
Ram Travel: 25"
Feed Rates. 12 — .5 to 36 inches per min.
Speed Rates: 12 — 40 to 1600 RPM
Spindle Motor 5 HP

Van Norman and only Van Norman Ram-Type Milling Machines give you the exclusive advantage of the adjustable cutterheads mounted on heavy sliding rams which provide *maximum flex-ability.* This means you get more production because there is less idle machine time.

And for *more cut-ability* . . . powerful spindle motors with up to 10 HP provide ample power for every milling cut. The extra heavy-duty rams, larger, heavier columns, bases and knee, saddle and table assemblies provide *maximum rigidity.*

Write for Bulletins describing these versatile Van Norman Ram-Type Millers, today.

Don't wait . . . for extra profits install a Van Norman Machine now! They are available on four purchase plans — Outright sale . . . Purchase on conditional sales contract up to 5 years . . . Straight lease . . . Lease with option to buy. See your dealer or write Van Norman Company.

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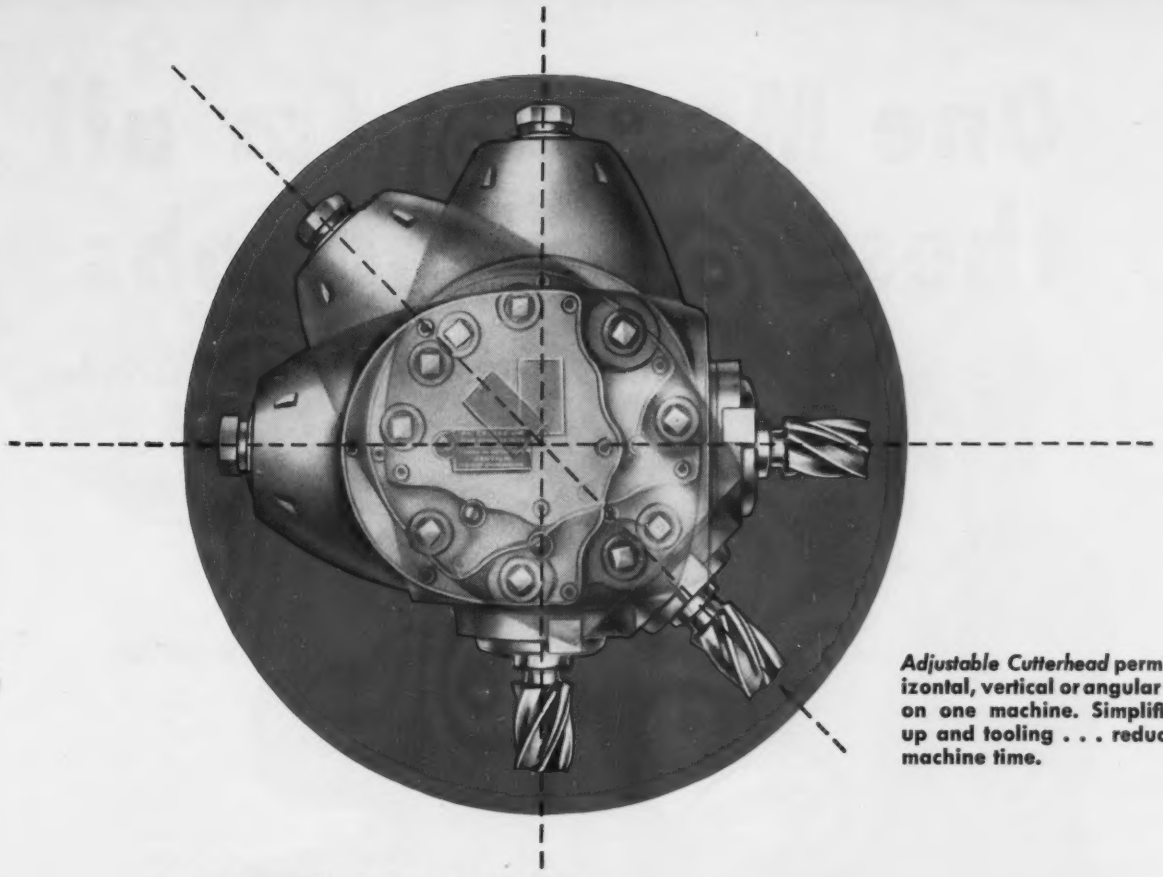
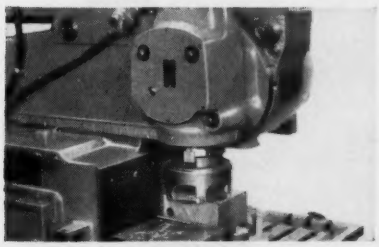
VAN NORMAN

MANUFACTURERS of—Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

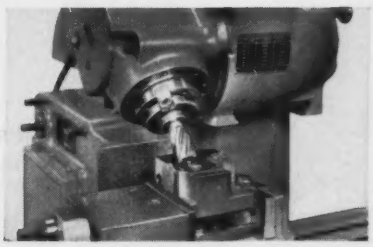


Adjustable Cutterhead **permits horizontal, vertical or angular milling on one machine. Simplifies set-up and tooling . . . reduces idle machine time.**

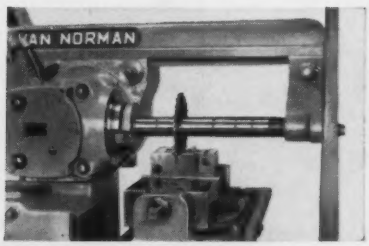
for greater Flex-Ability



With the cutterhead locked in the vertical position, a vertical milling operation is performed on the workpiece.

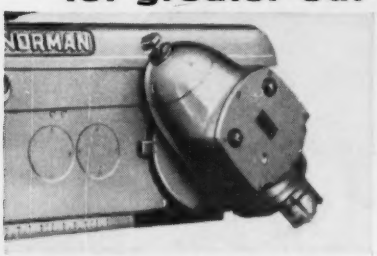


With the workpiece in the same set-up and the cutterhead in angular position, a V is milled in the work. Angular range of cutterhead is 0 degrees to 90 degrees.

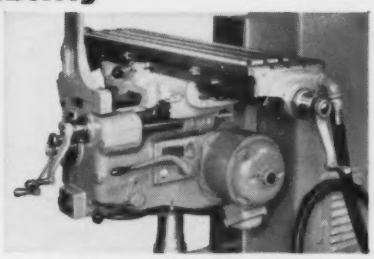


With the cutterhead in the horizontal position, a slot is milled in the work. Note that the set-up has not been changed.

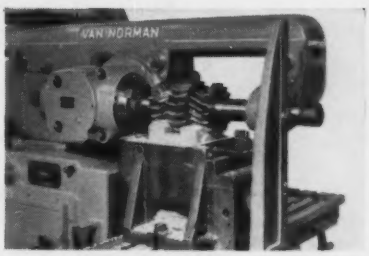
for greater Cut-Ability



New heavy-duty adjustable cutterhead, mounted on massive ram with 22″ bearing ways on column assures maximum rigidity and accuracy.



Rugged table, saddle and knee assemblies are designed as an integral unit for rigidity. New heavy motorized knee has direct drive 1HP feed motor.



A heavy horizontal multiple milling cut being performed on the miller. The rigidity of the machine prevents chatter.

COMPANY

SPRINGFIELD 7, MASSACHUSETTS

One Machine for all these grinding jobs

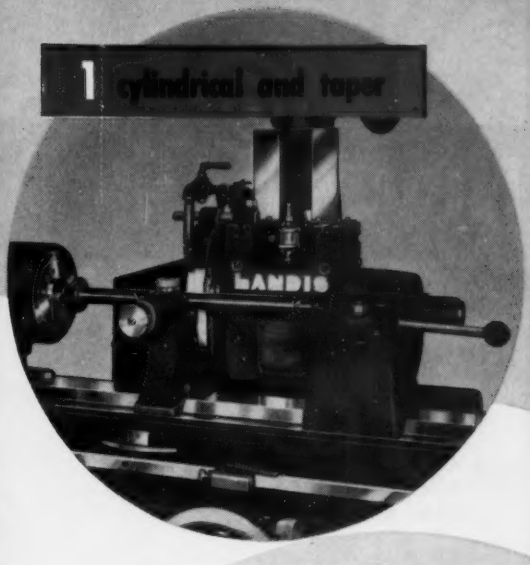
Landis Universal and Tool Grinder

LANDIS

precision grinders

LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U. S. A.

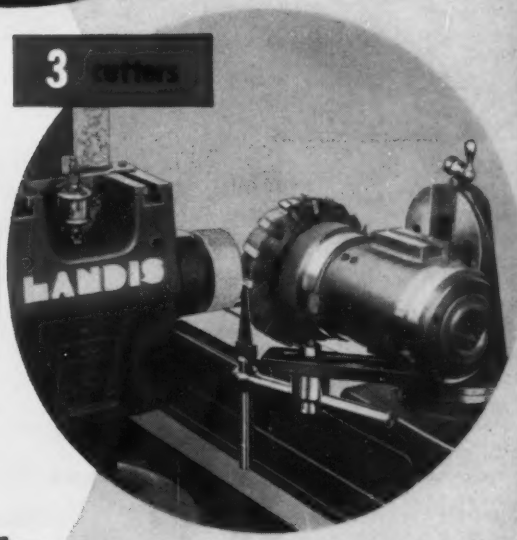
Landis 12" x 28" Universal and Tool Grinder —two machines in one—a tool grinder and a universal grinder. Catalog K - 53

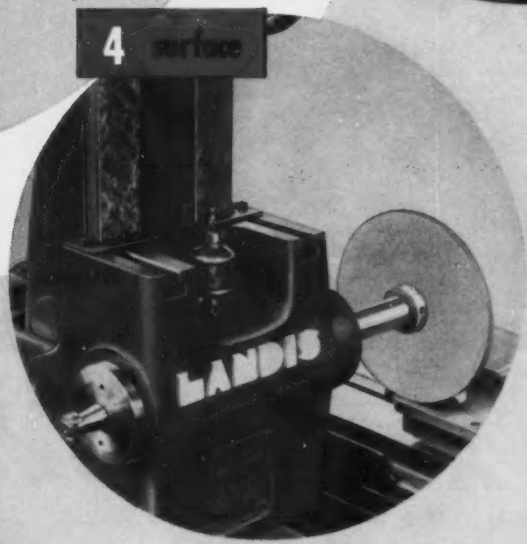


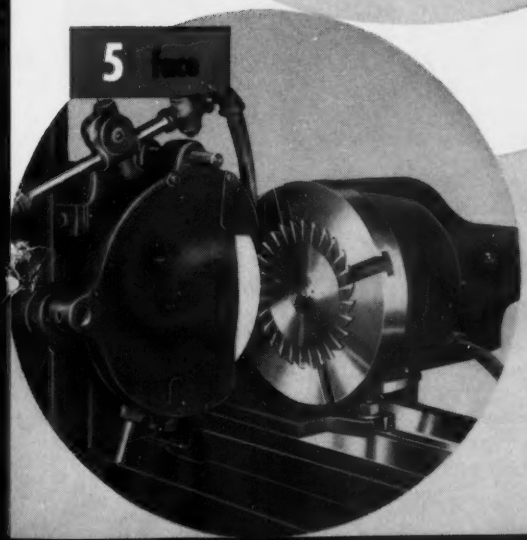
Also Performs These Grinding Operations:

6. Clearance on saws, cutters and reamers
7. Flutes on taps
8. Face of teeth on formed cutters
9. Spiral mill grinding
10. Milling cutters
11. Wet grinding
12. Dry grinding
13. Hobs
14. Parallel blocks, flat forming tools and dies
15. Screw machine and other forming tools
16. Angular wheel face
17. Reamers, taps and form cutters
18. Gear cutters
19. Face mills
20. End mills
21. Drills
22. Saws

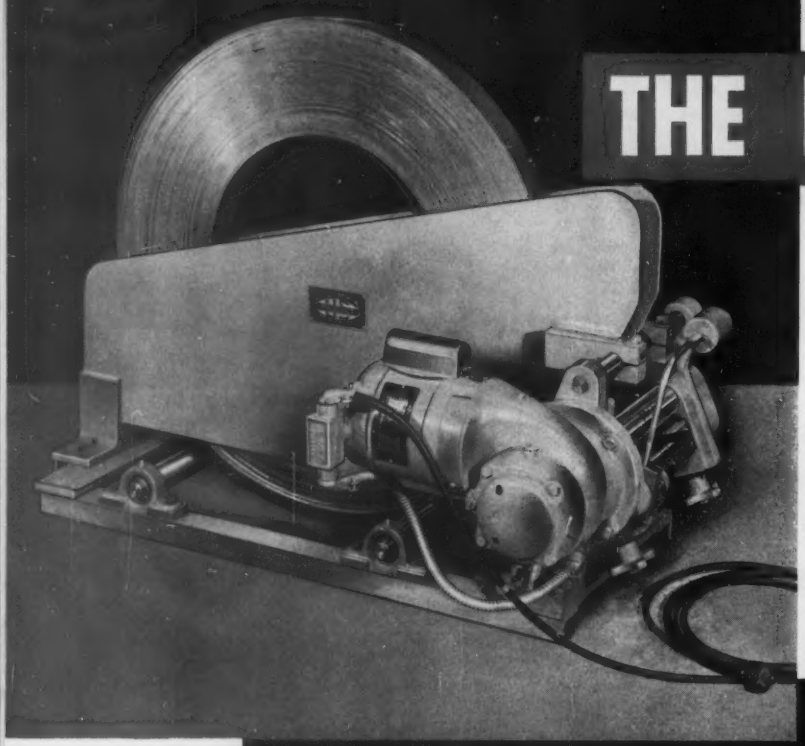
(All operations can be done with standard and extra equipment)





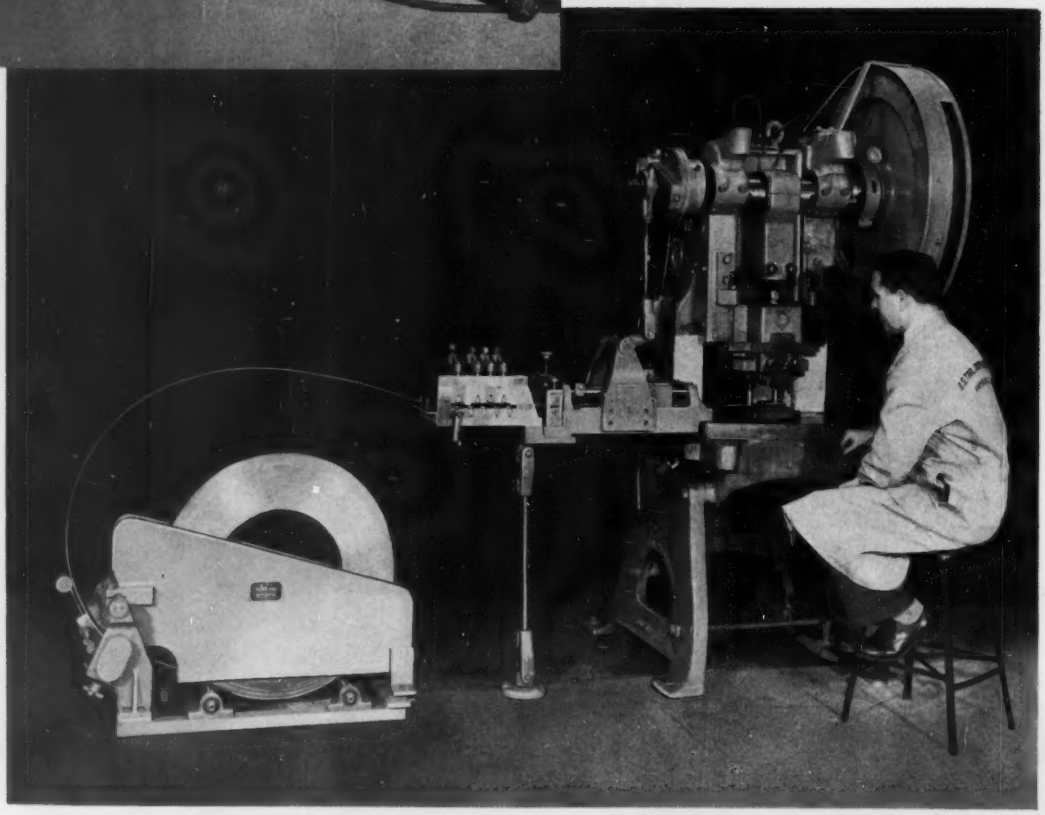


THE NEW U. S.



At left: The new ACC-1-9-B U. S. Automatic Coil Cradle, showing motor drive.

Below: The new U. S. Automatic Coil Cradle being used in a punch press set-up, together with a U. S. Slide Feed and a U. S. Plain Stock Straightener.



U. S. TOOL

AUTOMATIC COIL CRADLE

NEW CRADLE DESIGN

– for ease and speed in loading

GEARED MOTOR POWER

– for positive, rapid operation

If you are interested in press room "automation" . . . in making your press room operations faster and more efficient . . . check the features of the newest U. S. Automatic Coil Cradle. This cradle has a capacity for material up to 9 inches in width, in coils with an O.D. up to 40 inches. It is equipped with two coil rest rolls mounted on self-aligning roller bearings. A pair of hardened and ground power-driven take-out rolls unwind the material to the very end of the coil. The 1/4 HP geared motor provides output up to 52 feet per minute, and is started and stopped through a mercury switch loop control. Motors can be furnished to provide even higher output if required.

One of the most outstanding features of the new Cradle is the design which makes loading an easy, high-speed operation. The photographs show how the unit has been designed with the coil rest rolls as close to the floor as possible. It is a simple matter to place a coil in position—without raising it to a considerable height, or removing and replacing retaining arms, as would be necessary if a stock reel were used. All these features add up to greater convenience, easier operation and greater output.

In addition to the new Automatic Coil Cradle illustrated, the U. S. line includes Slide Feeds, Plain and Power-Driven Stock Straighteners, Scrap Choppers and other automatic press room equipment—all designed in a wide range of capacities to help make any press room operation faster, more accurate and more efficient.

If you have a press room—and press room problems—investigate the possibilities of U. S. Automatic Press Room Equipment. Send for Bulletin 80-M giving complete details and specifications.

COMPANY, Inc.

AMPERE
(East Orange)
NEW JERSEY

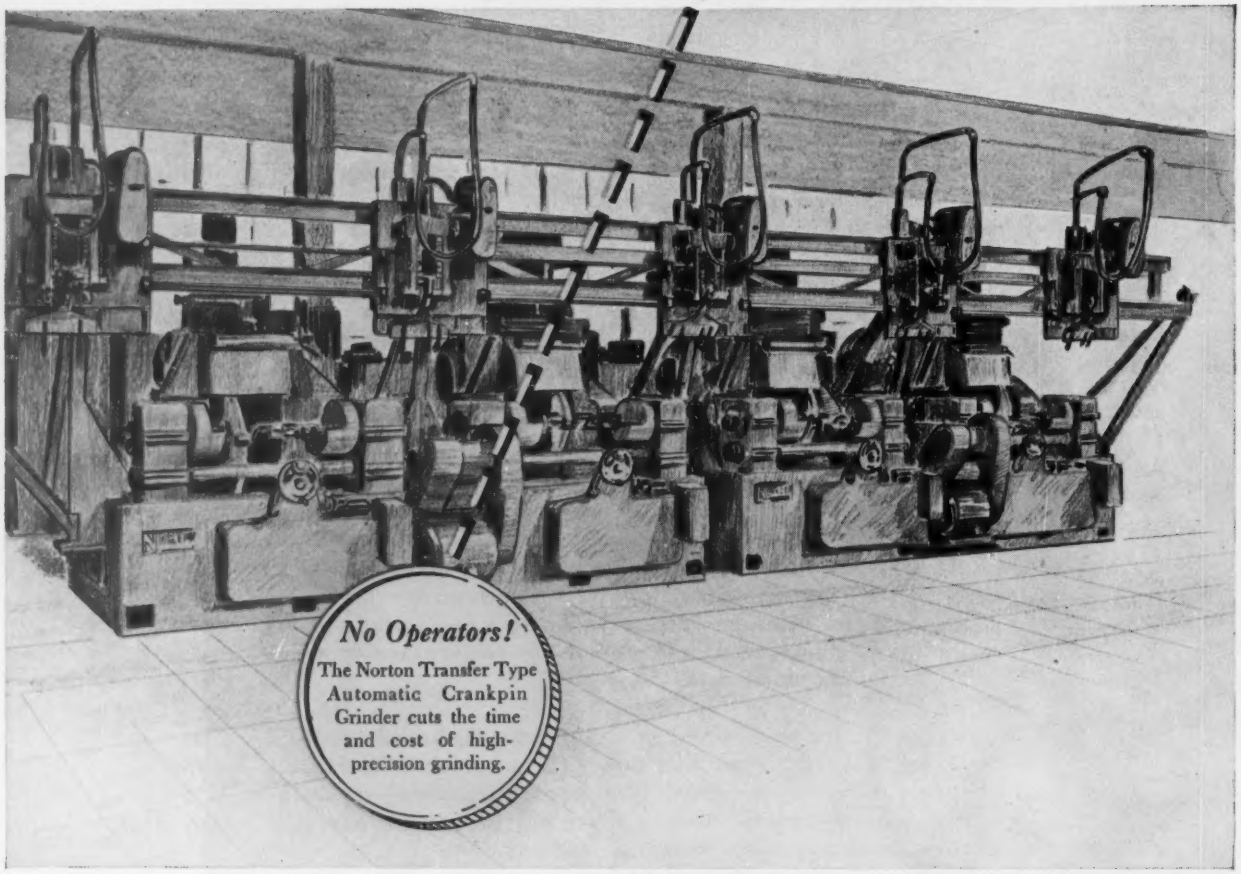
Builders of U. S. Multi-Slides—U. S. Multi-Millers

U. S. Automatic Press Room Equipment—U. S. Die Sets and Accessories

For more information on products advertised, use Inquiry Card, page 245

Norton Introduces AUTOMATION IN CRANKPIN GRINDING

Cuts Production Costs



All the operators' manual duties now mechanized in crankpin grinding

It was a good question:

Can an operation as intricate and exacting as grinding a crankpin be done by automated machines?

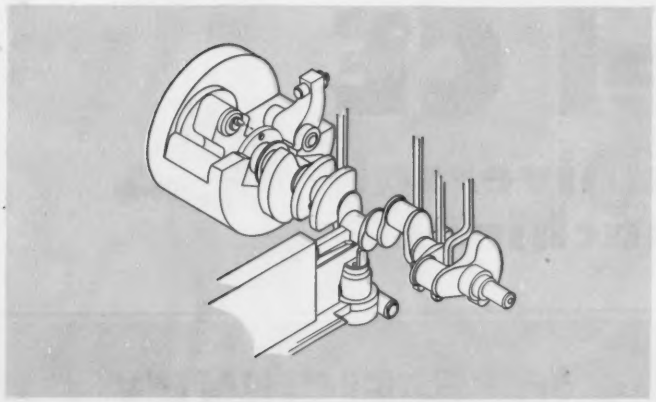
The question is a question no more.

Norton has answered it, "Yes."

Now *all* the manual motions once required of operators are handled automatically. Norton's modern machine for this really tough cylindrical grinding job does all adjusting, controlling, gauging and transferring of the work — plus the rapid, low-cost, high precision grinding required.

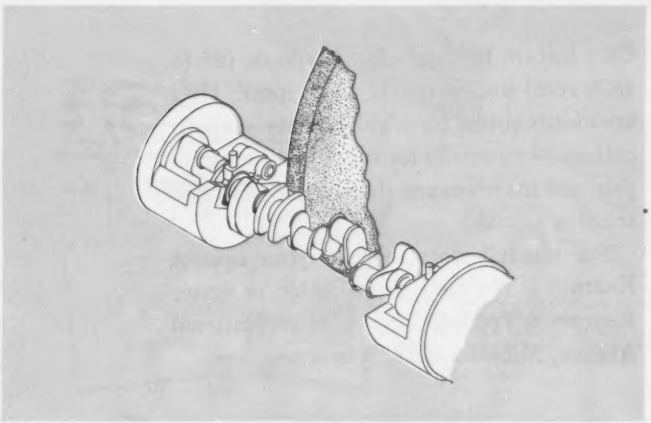
It is another Norton first. Norton is making rapid progress in applying Automation to various types of grinding.

4-way automation in new Norton machine



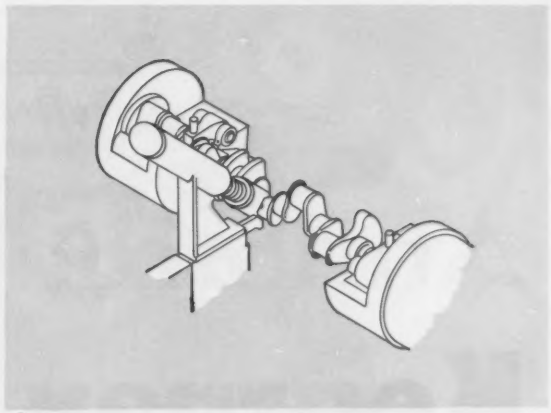
1. It adjusts automatically

Norton Automation locates the work in the grinder both angularly and longitudinally by built-in mechanism . . . grinding wheels are trued automatically . . . automatic compensation for reduction in wheel diameter is made by the feeding mechanism.



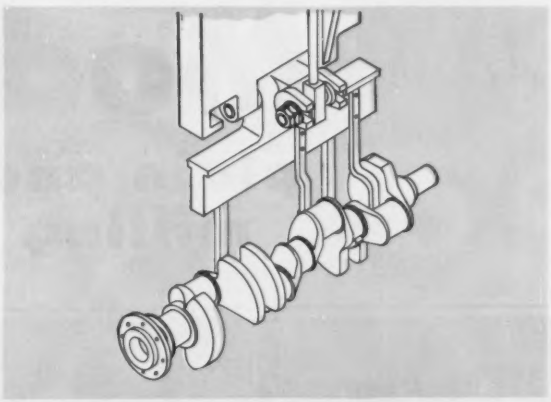
2. It grinds automatically

Being completely automatic, the grinders operate close to 100% efficiency all the working day. They can be pre-set to operate at a definite rate of production continuously. The unit can be controlled, when necessary, to by-pass any inoperative station.



3. It gauges automatically

Spark-out and work size are controlled by an electric gauge which contacts the work during grinding and automatically terminates the cycle by retracting the wheel slide when size is reached.



4. It transfers automatically

Five transfer units travel vertically to pick up and deposit the crankshafts at each station, moving simultaneously. These units are joined together, moving in unison horizontally to transfer the work between stations. The final unit carries ground crankshafts out of transfer machine.

New Automated Grinders Soon to Come . . .

This crankpin grinder is only one of many Norton advances in Automation. For more information about this and other Norton Automated Grinders, write Norton or see your Norton representative. And remember: only Norton offers you such long experience in both grinding machines and grinding wheels to help you produce more at lower cost. For more information, write NORTON COMPANY, Worcester 6, Massachusetts.

To Economize, Modernize with **NEW**

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GRINDERS and LAPPERS

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For more information on products advertised, use Inquiry Card, page 245

Announcing...*the* NEW

Kearney & Trecker

3 hp No. 2 — 7½ hp No. 3

Model CE

plain and universal milling machines

Designed specifically for EFFICIENCY, EASE and ECONOMY of operation

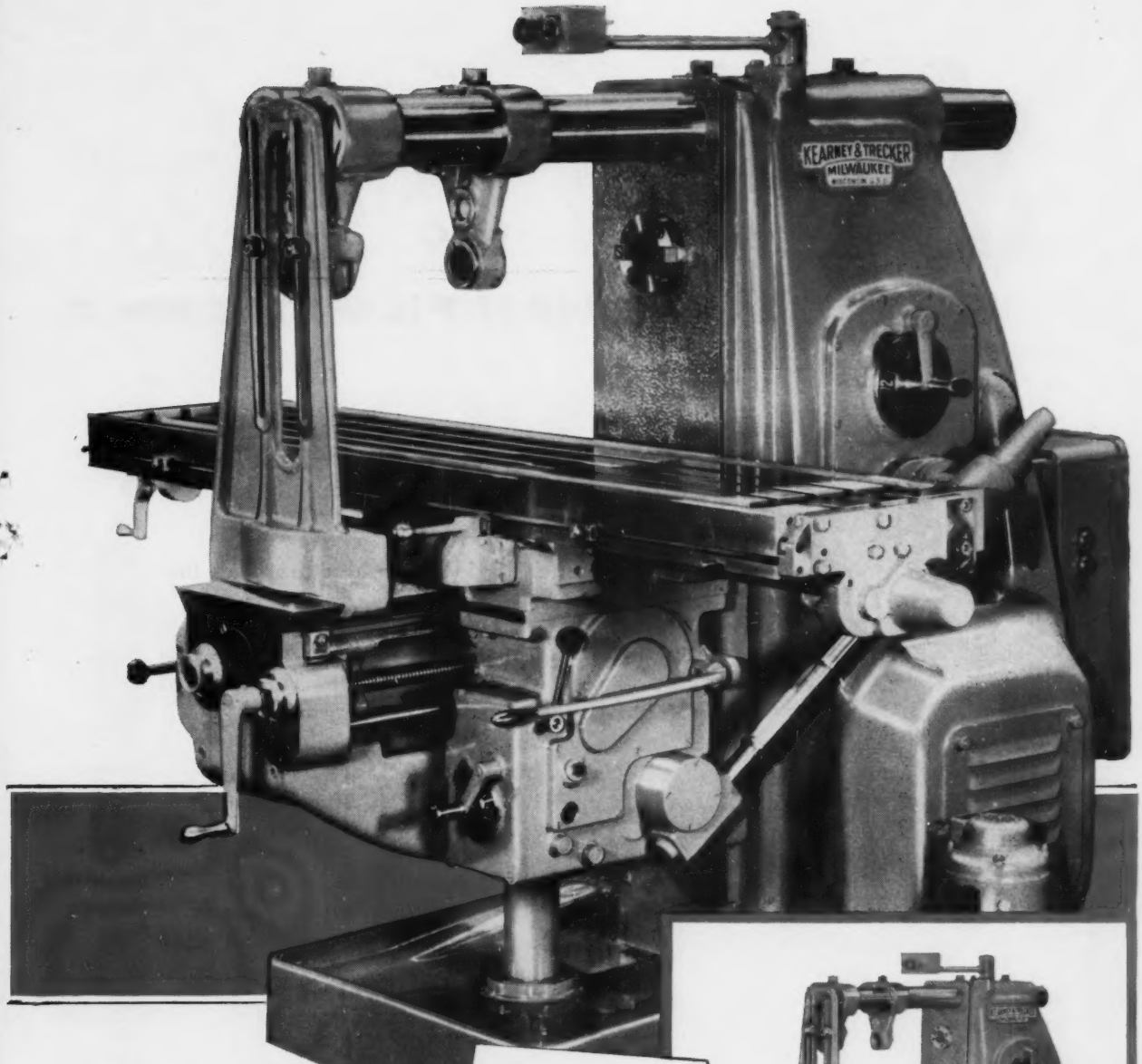
HERE'S Kearney & Trecker's answer to industry's need for a new milling machine that combines quality with *low initial cost*. The new Model CE's give you the three most wanted features — *Efficiency*, *Ease* and *Economy* of operation. What's more, these machines can be obtained under Tool-Lease.

The economical Model CE's are available in either No. 2 (3hp) or No. 3 (7½hp) size — both in plain and universal styles. The CE's feature 16 quick-change speeds (25 to 1300 rpm) and feeds (½ to 25 ipm). They are ideally suited for a wide variety of applications — especially for small tool shops, repair and maintenance shops and vocational training schools.

For the full story, contact your nearest Kearney & Trecker representative, or write: Kearney & Trecker Corp., 6784 W. National Avenue, Milwaukee 14, Wisconsin.

Kearney & Trecker Corporation

MILWAUKEE 14, WISCONSIN



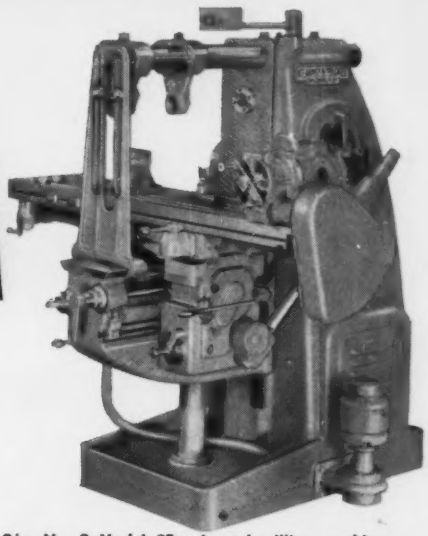
7½ hp No. 3 Model CE plain milling machine

NOTE: Standard equipment includes choice of only one arbor support. Overarm brace available at additional cost.

available for **TOOL-LEASE**

FREE CATALOGS!

Ask for complete data on Model CE milling machines, catalog No. CE-10, and for Tool-Lease bulletin, TL-10A. Also see our catalog in Sweet's. Write or call Kearney & Trecker Corp. — Telephone: GReenfield 6-8300.



3hp No. 2 Model CE universal milling machine

NOTE: Standard equipment includes choice of only one arbor support. Only Conventional Lead Attachment (shown above) is available in Model CE Universal machines. Overarm brace available at additional cost.

For more information on products advertised, use Inquiry Card, page 245

Introducing the New CINCINNATI FILMATIC No. 2

Over thirty years of experience in building and tooling thousands of centerless grinding machines has guided the design and construction of the new CINCINNATI FILMATIC No. 2 Centerless.

No other machine tool manufacturer has this extensive centerless experience.

The new CINCINNATIS are more efficient, more accurate, more versatile than ever before. Time-proved Cincinnati advantages have been retained . . .

Bed-rock grinding wheel spindle mounting
Filmatic grinding wheel spindle bearings
Lower slide construction for workrest
Simplified method of truing regulating wheel

And now these additional advantages are included . .

Infinitely variable regulating wheel speeds
Pre-loaded, precision ball bearing lower slide
Pressure lubrication of regulating wheel spindle bearings
Stabilized infeed screw

Of course, many more features desired by centerless grinder users are incorporated in the new CINCINNATI FILMATIC No. 2 Centerless Grinder.

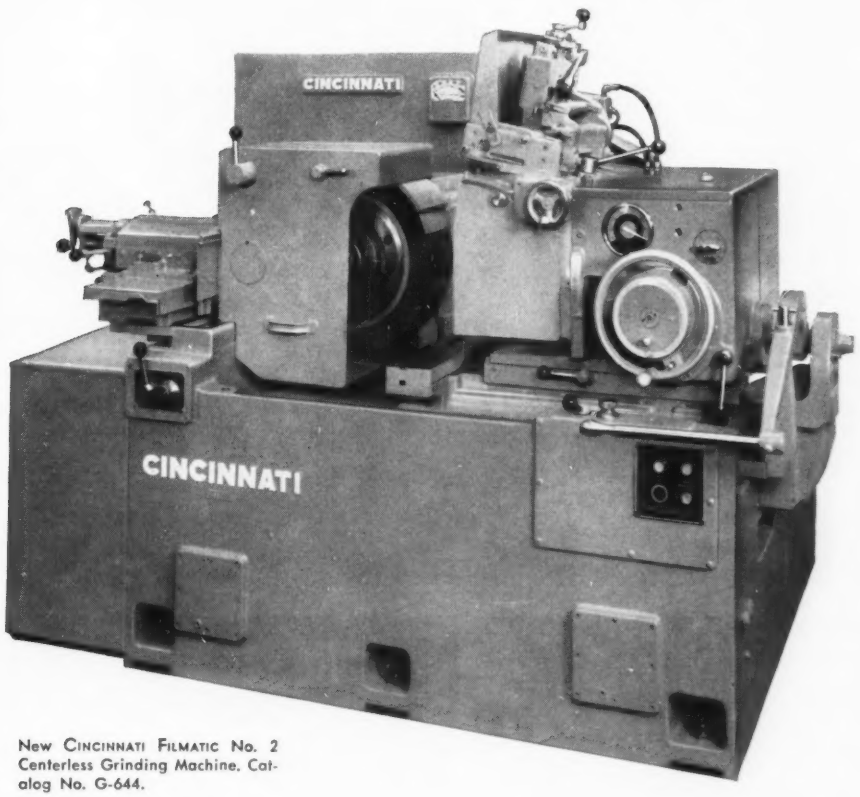
Would you like to know more about them? Write for new catalog No. G-644.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

FILMATIC

CINCINNATI

CENTERLESS GRINDING MACHINE

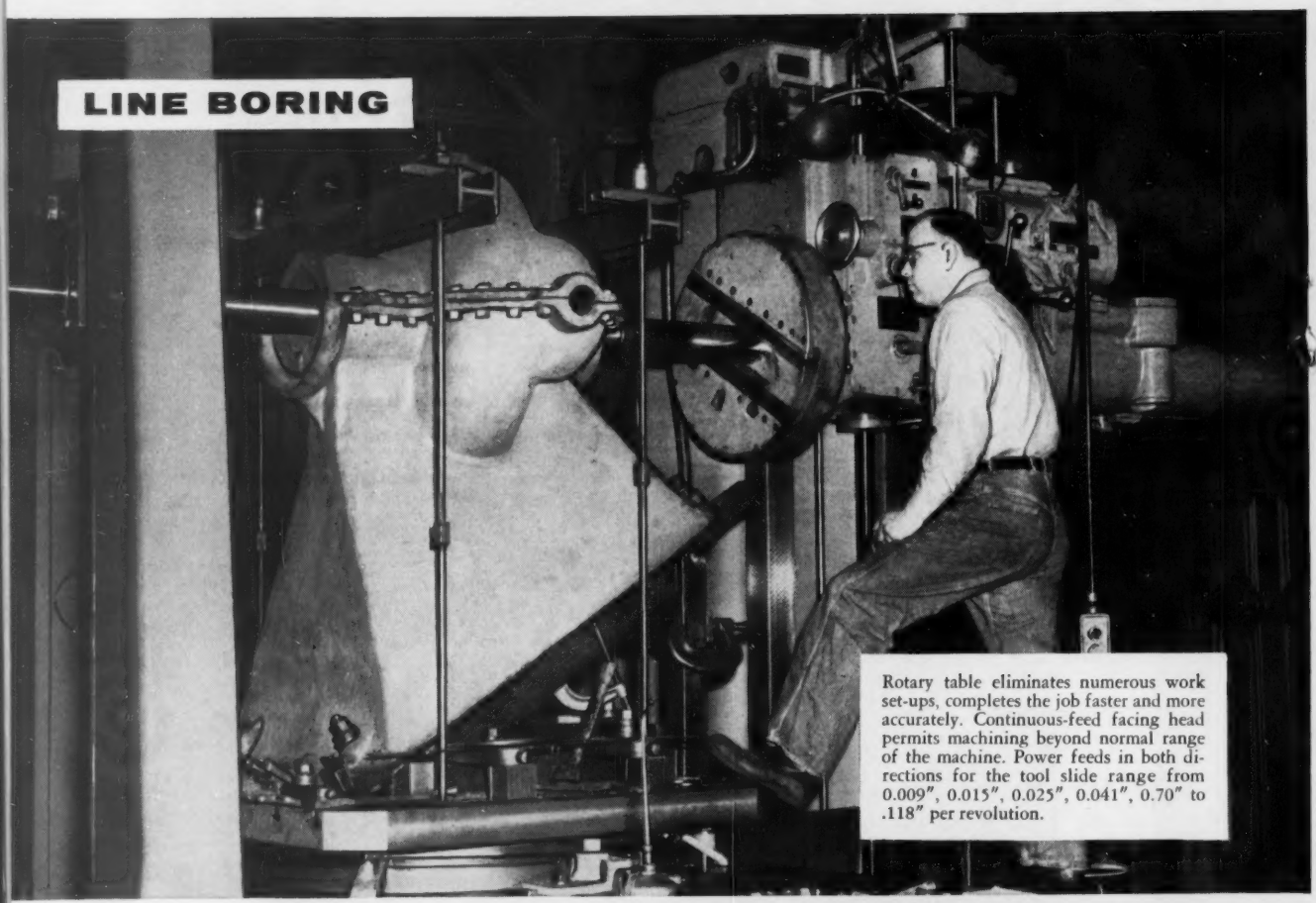


New CINCINNATI FILMATIC No. 2 Centerless Grinding Machine. Catalog No. G-644.

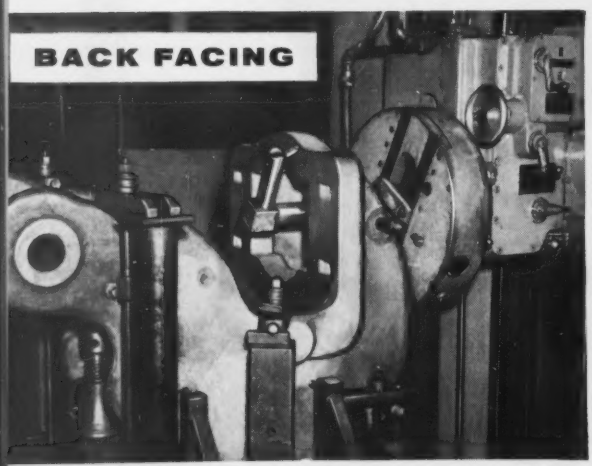
CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

CINCINNATI

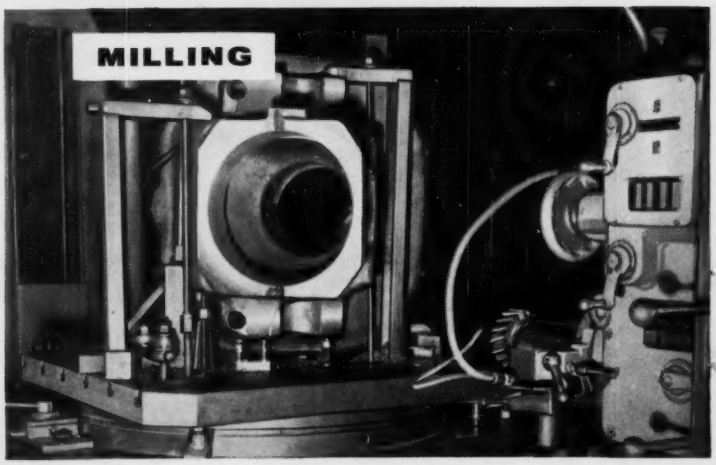
Look at all the operations performs with a



Rotary table eliminates numerous work set-ups, completes the job faster and more accurately. Continuous-feed facing head permits machining beyond normal range of the machine. Power feeds in both directions for the tool slide range from 0.009″, 0.015″, 0.025″, 0.041″, 0.70″ to .118″ per revolution.



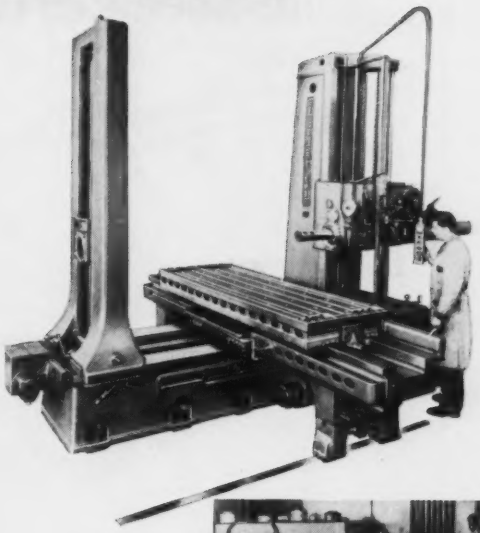
Telescopic tool holder extends through bore in workpiece to hold cutter for back facing operation.



Face milling cutter can be mounted quickly. For angular milling a G&L attachment can be used.

Wilmot Fleming single G&L machine

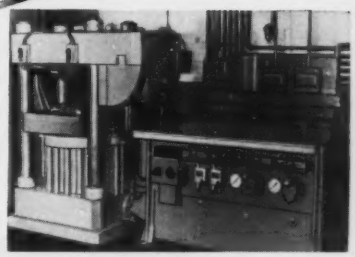
Here's how to tool-up and set-up workpieces to boost production and profits with a Giddings & Lewis 340-T horizontal boring, drilling and milling machine



Most versatile and busiest machine in the shop of Wilmot Fleming Iron & Steel Co., Philadelphia, Pa. — that's the Giddings & Lewis Model 340-T, horizontal boring, drilling and milling machine. Its ability to increase production, save many man-hours and boost profits, permits this manufacturer to perform a considerable amount of subcontract work. This is in addition to production machining of their own product lines.

With G&L's continuous-feed facing head, rotary table and 45 spindle speeds that are easy to select and change, the Model 340-T enables the operator to perform a broad range of machining operations . . . apply heavier cuts and faster cutting speeds.

Compare this 30 Series machine with any other in its class! You'll discover that feature-for-feature — dollar-for-dollar — you can't buy better.

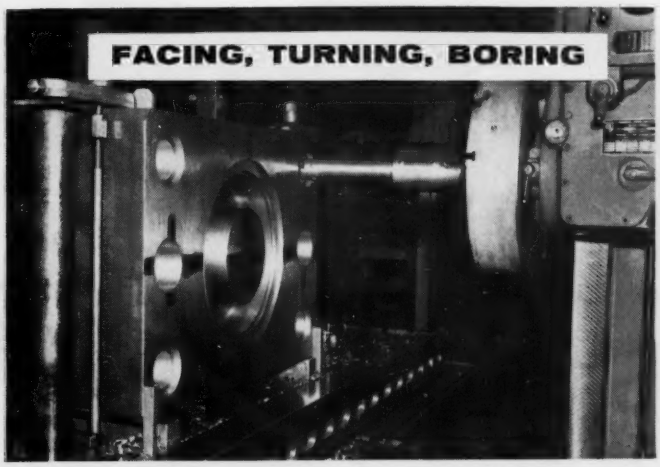


Large and small components of Wilmot Fleming's hydraulic press are precision-machined on G&L's 340-T.

Builders of the world's finest heavy-duty machine tools — Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers; Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools.

GIDDINGS & LEWIS MACHINE TOOL CO.

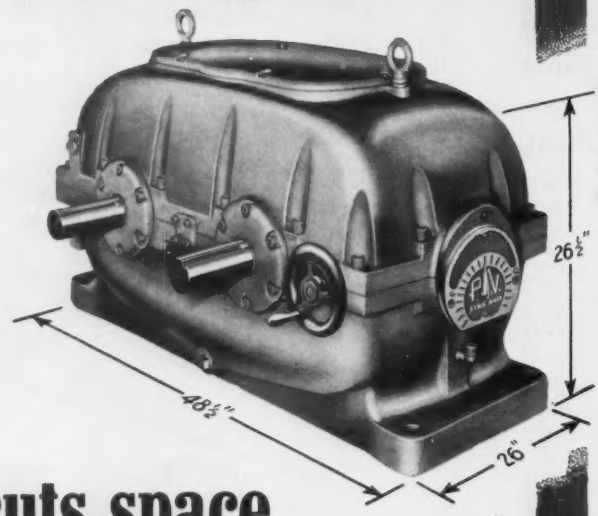
FOND DU LAC, WISCONSIN



With a continuous-feed facing head, facing, turning and boring operations are performed on one set-up.

True directional control for contour milling is accomplished manually or through power feed.

LINK-BELT 25-hp P.I.V. Variable Speed Drive



cuts space requirements up to 50%

LINK-BELT gives you all the advantages of positive, stepless speed changing in high horsepowers, too

ONE of the great advantages of P.I.V.'s positive, all-metal drive is dramatically illustrated by the Size 6. Compared to other speed changers in this hp range, it saves *70 cu. ft. of space!*

In addition, infinitely stepless regulation means you can select the exact speed you want—from maximum to minimum. Unaffected by temperature and atmospheric conditions, all moving parts are totally enclosed and splash-lubricated.

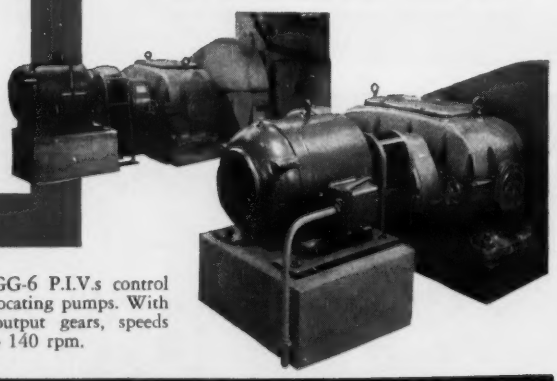
The Size 6 P.I.V. is built in three types: The basic drive . . . with input *or* output gears . . . with input *and* output gears. All are available in a wide range of ratios, 20 to 25 hp.

Get the facts on the Size 6 from your nearest Link-Belt office or distributor. You'll receive a copy of Folder 2374. And for information on the complete P.I.V. line, ask for Book 2274.

LINK-BELT P.I.V. VARIABLE SPEED DRIVE

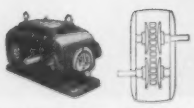
13.594

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

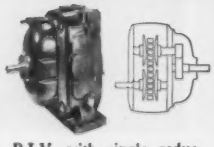


Two Link-Belt HGG-6 P.I.V.s control the speed of reciprocating pumps. With both input and output gears, speeds range from 46.5 to 140 rpm.

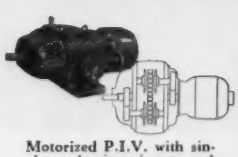
4 OF 16 P.I.V. TYPES
HORIZONTAL OR VERTICAL MOUNTINGS
½ TO 25 HP—
RATIOS TO 6:1



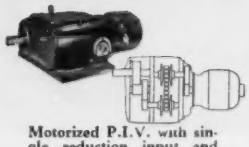
Basic, Positive, Infinitely Variable (P.I.V.) Speed Drive.



P.I.V. with single reduction input or output helical gears.

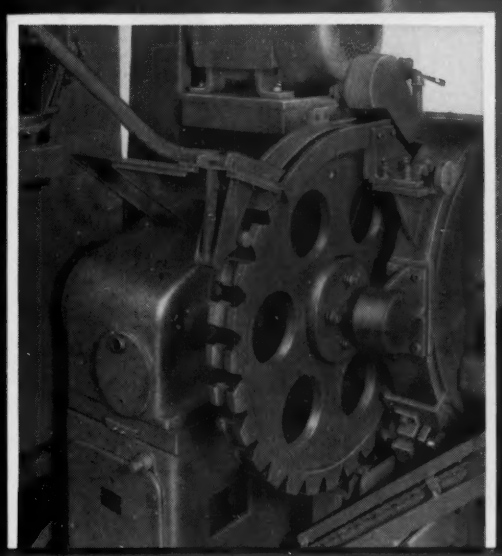


Motorized P.I.V. with single reduction input and output helical gears.



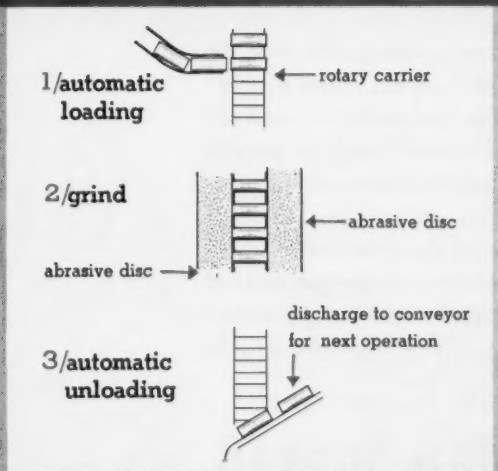
Motorized P.I.V. with single reduction input and double reduction output helical gears.

For more information on products advertised, use Inquiry Card, page 245



Gardner No. 125-26" Double Spindle Grinder

Automatic Operation Gives Grinding Output of 1800 Pieces per Hour



TWO parallel ends ground in ONE operation

work data	
PART	Piston pin 3.026" long x .980" O.D. x .722" I.D
PRODUCTION	1800 per hour.
STOCK REMOVAL	.020" overall.
TOLERANCES	.0015" for parallelism; .0025" for uniformity.
ABRASIVES	2 Gardner Yellow Rim Wire-Lokt Discs.
TOOLING	Vee-notched rotary work carrier with hopper feeder and automatic unloading to conveyor.

GARDNER MACHINE COMPANY
414 Gardner St., Beloit, Wisconsin, U. S. A.

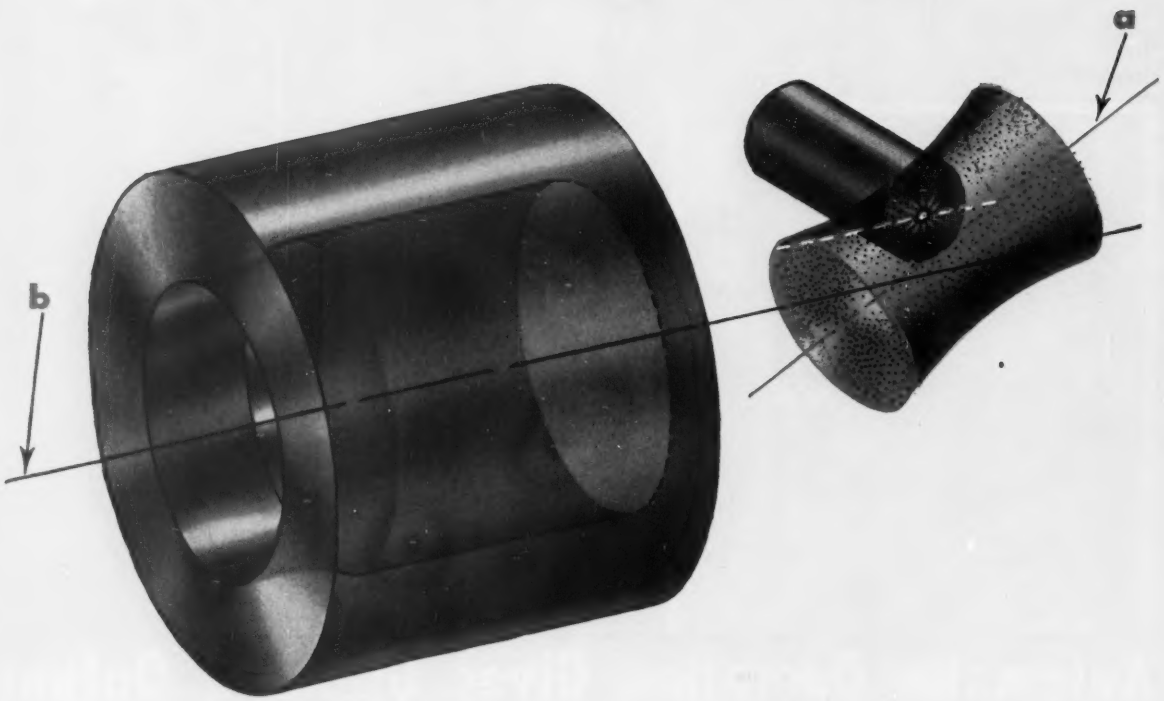
GARDNER

precision disc grinders

131M

alignment

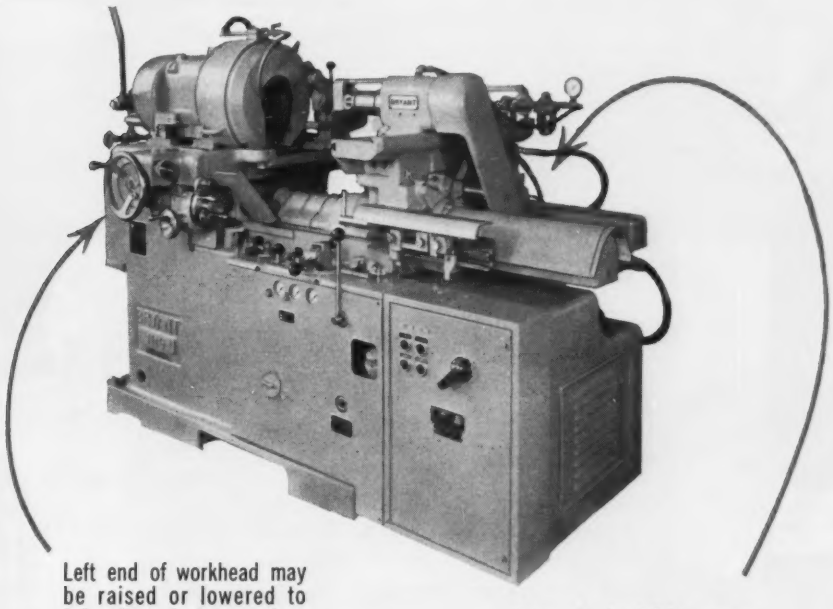
for better internal grinding



IT is generally believed in internal grinding that once the grinding wheel passes the diamond, the form of the wheel will be a perfect cylinder. In our illustration the wheel is tipped as it passes the diamond and an hourglass form is generated on the wheel. This condition is not peculiar to an internal grinder. The same form is generated in turning an O.D. on a lathe if the tailstock is either high or low.

The path of the diamond is a straight line across the surface of the wheel, but the wheel will not contact the work on the same straight line. Contact may be at a point on each end of the wheel. Since the wheel does not contact across its full face, wheel wear will be excessive and the wheel will act soft.

The geometry of the hole may be upset as in the illustration, with the result that the back of the hole will be tight. Neither turning the workhead nor changing the length of traverse will correct this error. Because the wheel is contacting at either one or two points, instead of a straight line, the surface finish will be poor. The remedy is to correct the alignment by bringing the wheel center line "a" parallel with the path of the wheel and in plane with the work center line "b".



Left end of workhead may be raised or lowered to bring its axis into a plane parallel with the wheel path.

Rear of wheelslide may be adjusted to insure straight line motion of the wheel.

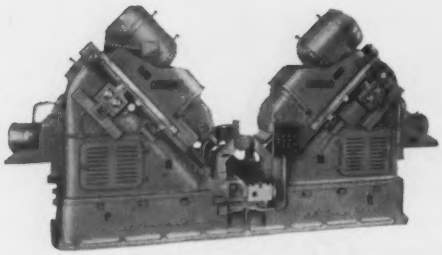
This machine is for general purpose hole grinding. It has convenient centralized controls and all features necessary to handle a variety of work with minimum time and effort needed for changing jobs. For stable 3-point support, the wheel spindle is mounted on a cylindrical bar which is supported on 2 cylindrical bearings. The rear of the slide is supported on a hardened and ground guide plate. Workhead may be swiveled for grinding tapers up to 90° included angle. Provision is made for mounting a face grinding spindle in addition to the hole grinding spindle. The No. 1116 will swing 16″ with 12″ max. hole depth. Write for folder.

Write for "Alignment" booklet which gives complete details on this interesting subject. Also ask for booking form on new sound, color movie — free showings arranged for engineering groups.

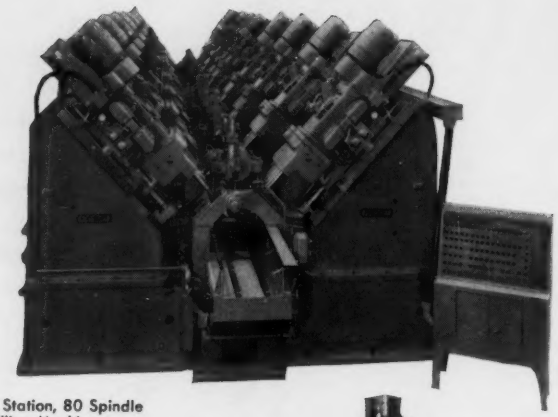
Bryant Chucking Grinder Co.

Springfield, Vermont, U. S. A.

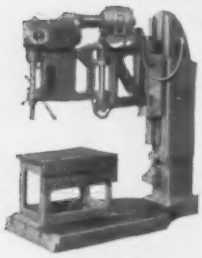
Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates



Two-Way Hydraulic Feed
Vee Type Stub Boring Machine



17 Station, 80 Spindle
Drilling Machine



Unique Bracket Type Hammond
Radial Drilling and Tapping Machine

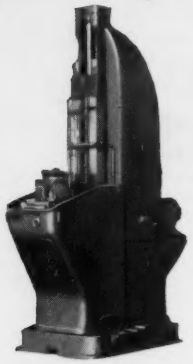
FOOTBURT

line of production machines

• Way Type Drilling, Boring, Reaming, Tapping and Milling Machines with One, Two or More Ways . . . Station Type Machines . . . Center Column Type Machines . . . Cylinder Boring Machines . . . Inverted Drilling Machines . . . Surface Broaching Machines . . . Sensitive Drilling Machines . . . Hammond Radial Drilling Machines . . . Manufacturing Type High Duty Drilling Machines . . . Independent Feed Drilling Machines . . . Special Machines.

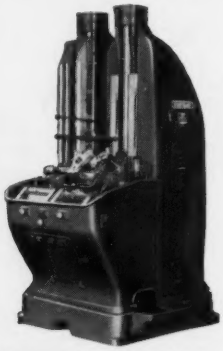
THE FOOTE-BURT COMPANY, Cleveland 8, Ohio

Detroit Office: General Motors Building



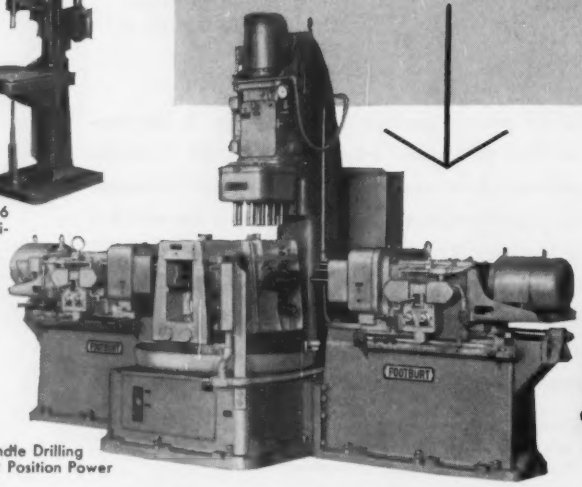
Single Slide Broaching
Machine 5, 10, 15 and 25 Ton
capacity

Stub Type Cylinder
Boring Machines

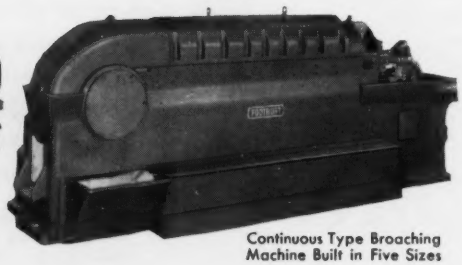


Duplex Surface Broaching
Machine 5, 10, 15 and 25 ton
capacity

1, 2, 3, 4 and 6
Spindle Sensi-
tive Drilling
Machines



3-Way 31 Spindle Drilling
Machine with 2 Position Power
Indexing Table



Continuous Type Broaching
Machine Built in Five Sizes

engineered for production

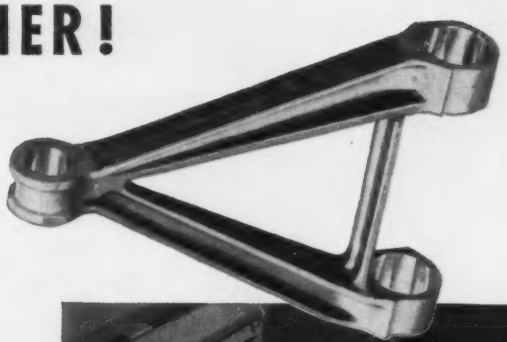
FOOTBURT

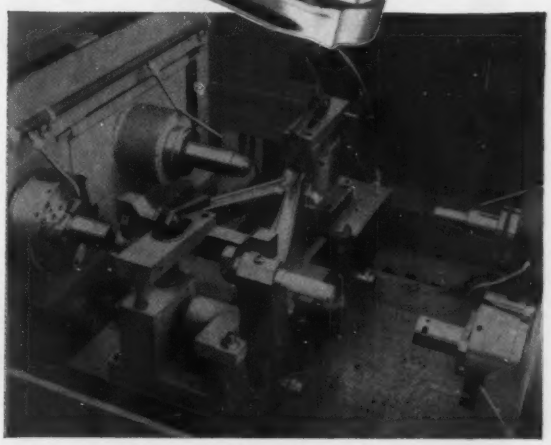
MACHINE TOOLS

For more information on products advertised, use Inquiry Card, page 245

DOWN LIKE A FEATHER!

. . . a little safer, a little smoother because this part was BORIZED*





This Model 422, is used to bore, counterbore and chamfer seven different torque arms for landing gear components. Aligning rails on both the boringhead bridges and the fixture sub-base aid in accommodating the various parts.

Basic fixture equipment consists of angle plate type with swinging gate locator and hand cam clamps — gate locator is interlocked so that machine will not operate unless part is correctly located.

You're heading for the runway on final approach — fifty tons of airliner hurtling through space at over 100 miles an hour, yet settling to the earth as lightly as a feather. This is the time when a lot of things must work *just right.*

That they do so, thousands of times a day at airports the world over is a real tribute to the aviation industry. Such performance is made possible only through the utmost precision in every step of manufacture. That's why so many parts of the modern aircraft are borized. Here, for example, is a torque arm for a landing gear, borized on a Heald Model 422 Bore-Matic.

Whenever a part is borized, you can be sure of three things. A finer, longer-lasting, precision made part. Important savings in time and production cost. A definite competitive advantage for your product. That's why IT PAYS TO COME TO HEALD.

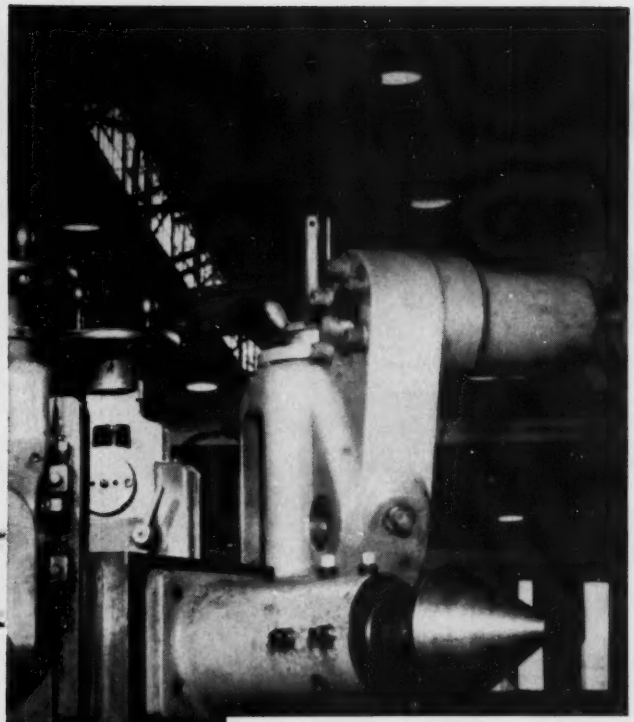
* *Precision finished by a Heald-engineered method on a Heald Bore-Matic.*

THE HEALD MACHINE COMPANY

WORCESTER 6, MASSACHUSETTS

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER &



Here's a good example of what happens when a part is machined on the *right* machine with the proper tooling!

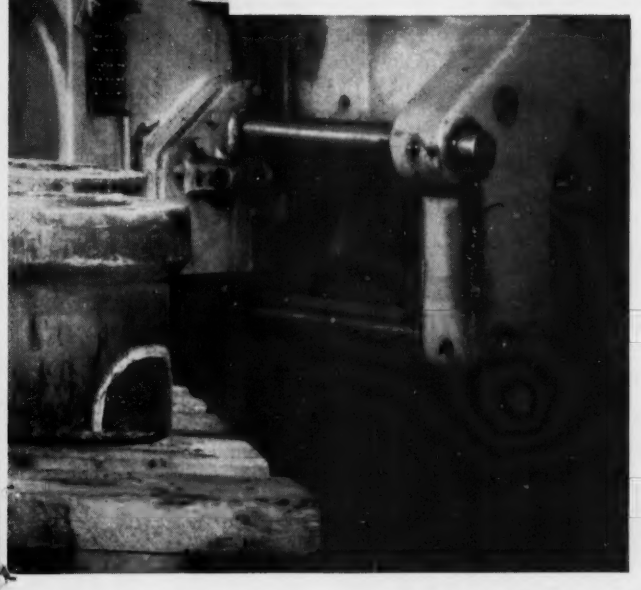
The machine was a new Warner & Swasey 4-A Turret Lathe installed in 1953 at the Emsco Manufacturing Company plant at Houston, Texas. It replaced an 8-year-old saddle type turret lathe.

Previous time for machining a large steel forging was 1 hour 54 minutes. This involved boring a hole to .001" tolerance, facing the end, a two inch turning operation on the 11" O.D., single pointing a 30° angle two inches long, grooving a 1½" wide square groove on the O.D., and breaking the corners.

After the job was transferred to the new Warner & Swasey, and following the setup and tooling recommendations of our Field Engineer, *the operation was completed in 30 minutes!*

Another operation transferred to this Warner & Swasey was machined in one-fourth the previous time! On a third part the operator produced 13 hours' work in one shift!

Machining time cut from 1 hr. 54 min. to 30 minutes!



Translating these time savings into production, Emsco reports that production of parts transferred to the Warner & Swasey has been increased by 32%. Operators like the machine's ease of handling and its ability to hog off metal.

This is a record of just one machine, but it emphasizes the profit possibilities open to you when the job is done on the *right machine,* properly tooled, and job-analyzed by a turning specialist . . . a Warner & Swasey Field Engineer. Call him in on your replacement problem. He's a good man to work with.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

For more information on products advertised, use Inquiry Card, page 245

JUST AS A NEGATIVE guarantees you an exact duplication of a photograph each and every time, you are always assured a

A manufacturing achievement that will save you money and increase your production . . .

POSITIVE DUPLICATION of an original grinding wheel every time through the CINCINNATI (PD) Manufacturing Process.

NOW!

Cincinnati Grinding Wheels offer

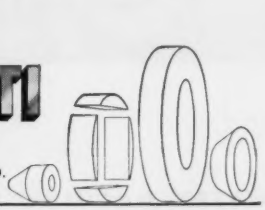
PD POSITIVE DUPLICATION

It's the greatest grinding wheel development in years! For through the CINCINNATI (PD) Manufacturing Process you are assured a Positive Duplication of the original wheel *every* time you reorder.

"On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will *act and grind exactly alike. Yet they are priced no higher than ordinary wheels.*

Let us prove to you how CINCINNATI (PD) WHEELS can save you money and increase your production. Just contact us and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

CINCINNATI
Grinding Wheels
THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio



For more information on products advertised, use Inquiry Card, page 245

Why operators are dreaming of a ~~White~~ PINK Christmas

. . . Because pink CIMCOOL°—the radically new and different cutting fluid—is *one of the greatest working improvements in years.* It leaves no slippery film on shoes, floor, machine or work. It doesn't soil clothing or hands. It contains no skin irritants.

And look at some other reasons why machinists say *every day* is Xmas when Cimcool is on the job: Can't smoke. Can't burn. Virtually eliminates rancidity and foul odors. Cools so fast that tools and chips actually stay cool to the touch. And this revolutionary chemical emulsion *does a better job.*

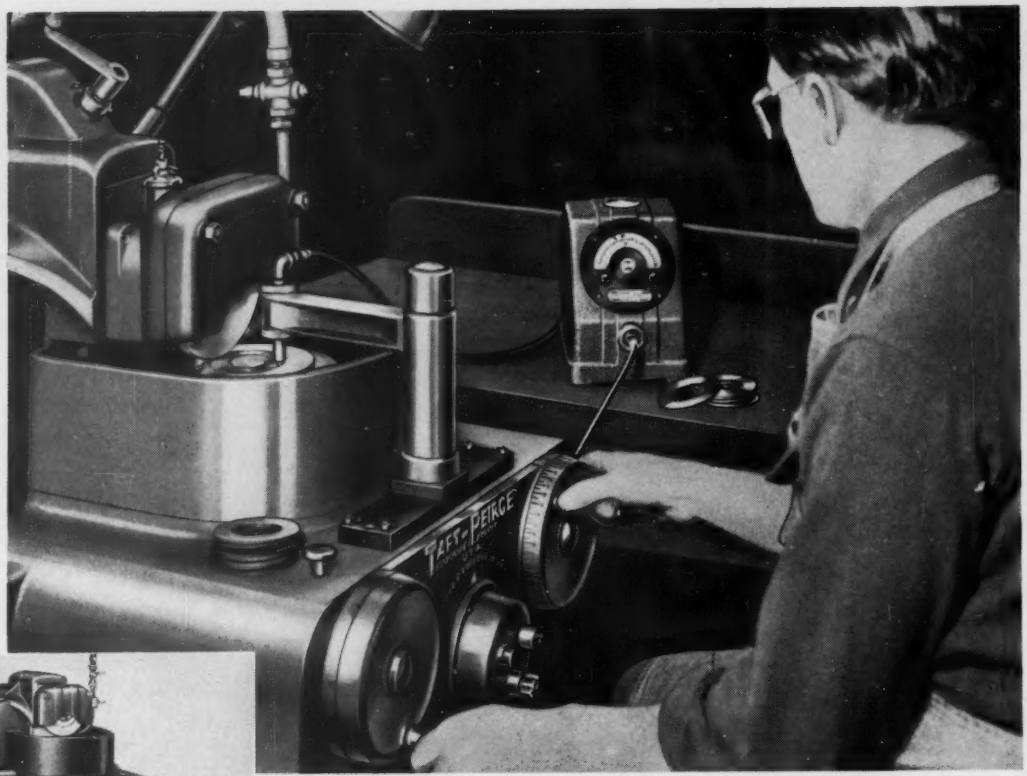
So why not make their dream become *a reality* by switching to Cimcool? If you want proof that Cimcool *makes jobs better while doing a better job,* we'll be happy to provide a demonstration. Just write us and we'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Or, if you prefer, write for our free booklet, "Cimcool Defeats Heat." Address, Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

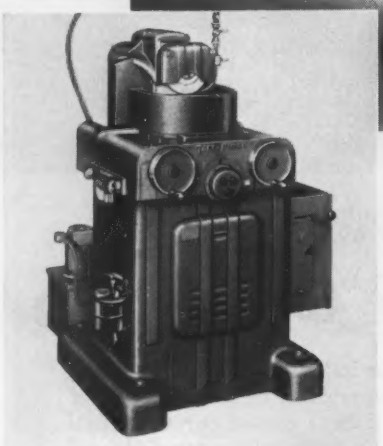
CIMCOOL

for 85% of all metal cutting jobs

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.



Grinding slitting knives to within .0001". Air gage permits on-the-job size control.



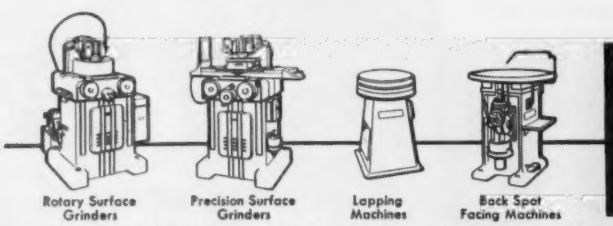
THIS 6" ROTARY GRINDER Grinds To .0001"

Taft-Peirce Designed It To Speed and Simplify Precision Grinding

Hard to believe but true — this Taft-Peirce 6" Rotary Surface Grinder makes grinding to .0001" an amazingly simple job. Exceptionally accurate, sturdy, vibrationless. An exclusive vernier feed permits precise vertical settings of .0001" instantly . . . exactly. Takes the guesswork out of finish grinding. Gives you flatter, finer surfaces.

And here are two more important features. A simple adjustment tilts the wheelhead up to 30 degrees in the vertical plane. The work spindle and superpower magnetic chuck tilt 7½ degrees forward or backward. This chuck holds even very small workpieces firmly and dependably in the center of the faceplate.

Operators report undiminished accuracy over unusually long periods, sharply reduced wheel-wear, and negligible maintenance. Ask for the Taft-Peirce 6" Rotary Grinder Bulletin for more information.

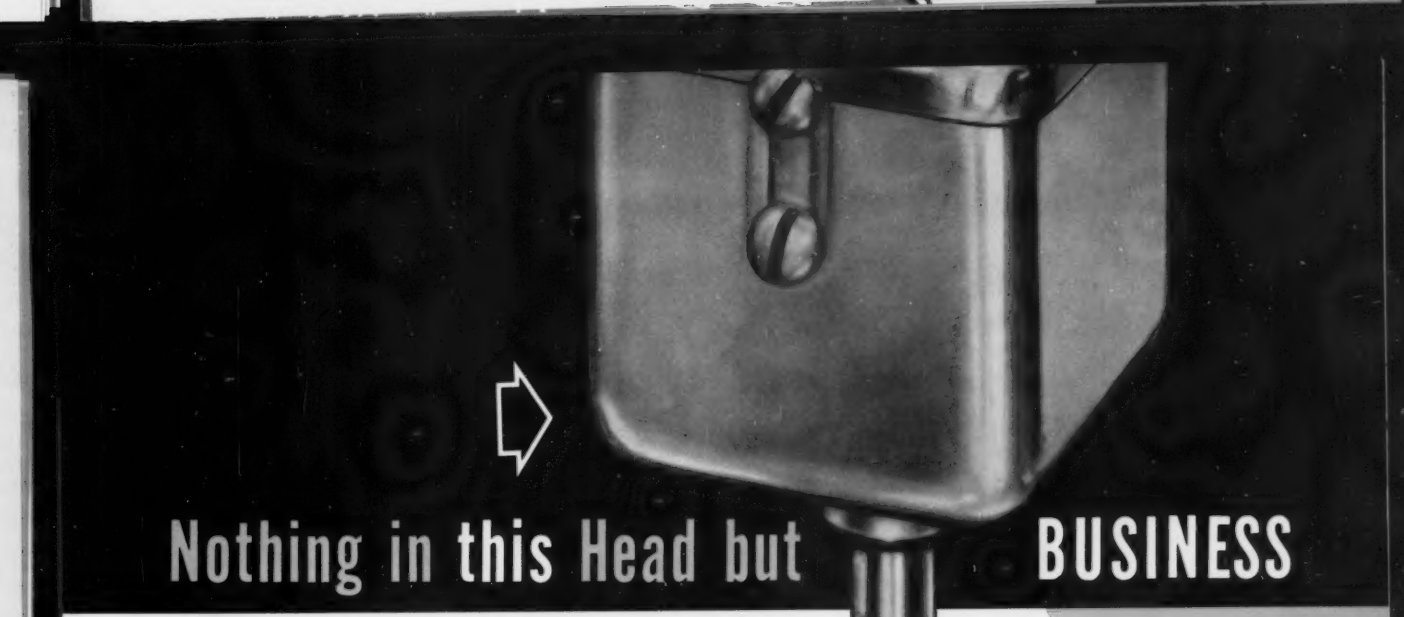


T-P means Top Precision

T P

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

For more information on products advertised, use Inquiry Card, page 245



Nothing in this Head but BUSINESS

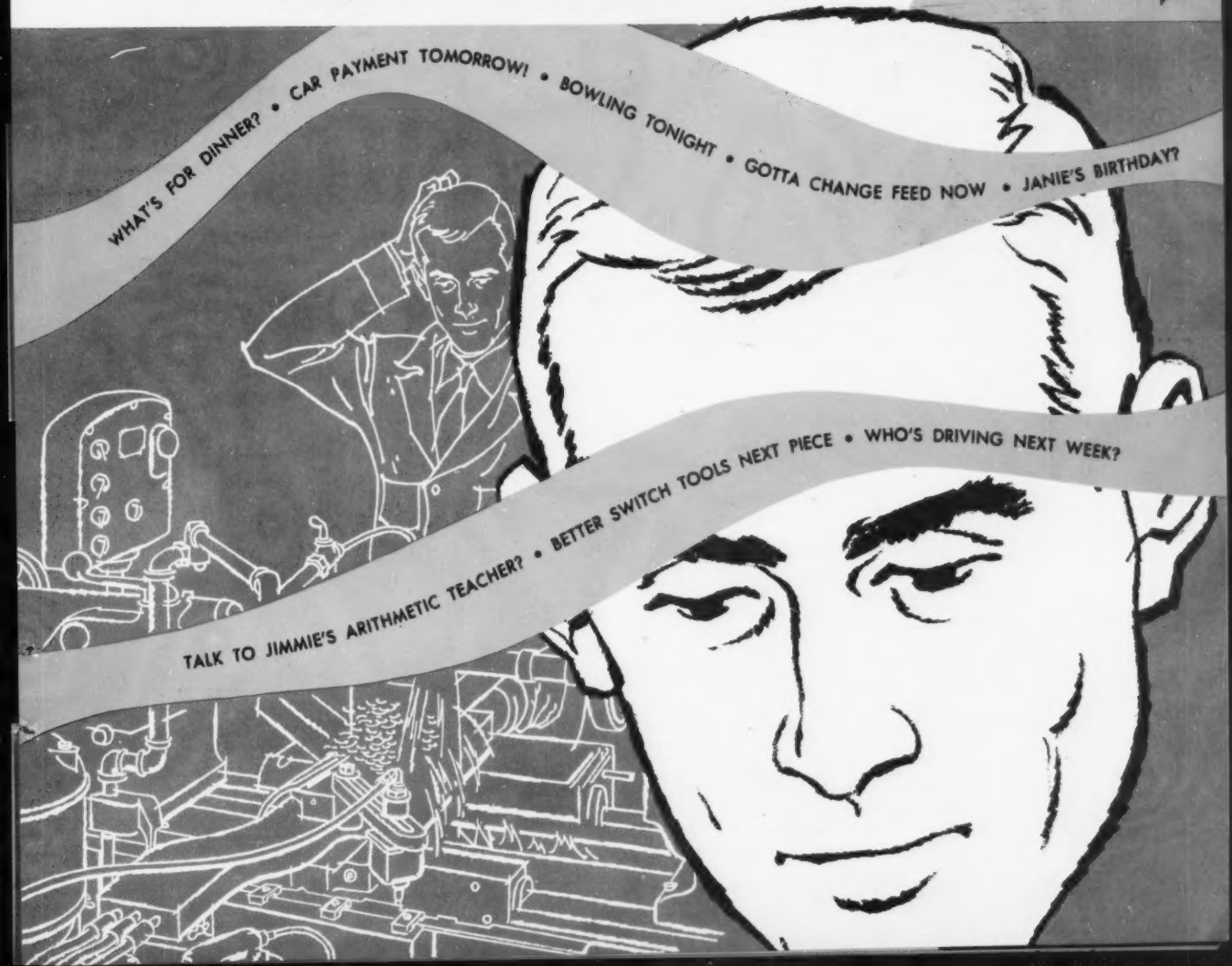
See for yourself how Monarch Air-Gage Tracer Controlled Turning—

Speeds production—virtually eliminates spoiled work due to human error—no need for repetitive measurements—cuts turning time—reduces or eliminates grinding time—slashes setup time—equally suitable for both long and short runs.

THE MONARCH MACHINE TOOL COMPANY • Sidney, Ohio

These Job Reports Prove It

SEE NEXT 3 PAGES


WHAT'S FOR DINNER? • CAR PAYMENT TOMORROW! • BOWLING TONIGHT • GOTTA CHANGE FEED NOW • JANIE'S BIRTHDAY?
TALK TO JIMMIE'S ARITHMETIC TEACHER? • BETTER SWITCH TOOLS NEXT PIECE • WHO'S DRIVING NEXT WEEK?

WHAT A HEAD FOR BUSINESS!

Phenomenal reductions in turning time, when the Monarch Air-Gage Tracer starts turning the work, are reported to us over and over again by pleased and happy customers. See if any examples on these pages or the next are similar to any problem of your own. If not, the coupon on the second page following will bring you full details and many more examples—or a job report of your own.

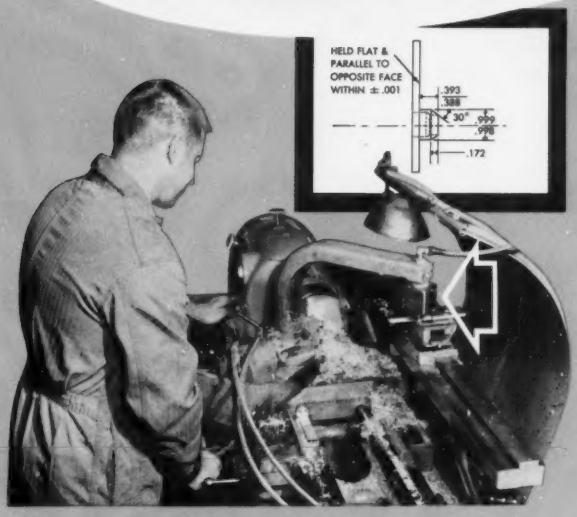
As you analyze these cost-reducing production figures, don't overlook the Air-Gage Tracer's accuracy and versatility. The movement of slide to control point repeats itself within a limit of .0001", making it the most accurate of all duplicating devices. Recommended for turning multiple diameter shafts, and turning, boring and facing contours, its versatility accommodates it to a great variety of work.

Why can't the Air-Gage Tracer give *your* production a boost? Can't you use help like this? Study the jobs—send in the coupon—and let Monarch take it from there... *The Monarch Machine Tool Co., Sidney, Ohio.*

AIR-GAGE TRACER TIME, FLOOR TO FLOOR—6 Minutes.
OLD TIME—50 minutes.

Part—Bronze Worm Gear. **Machine**—20" Series 60 "Air-Gage Tracer." **Material**—high tensile manganese bronze. **Operation**—rough and finish turn complete. **Cutting tool**—carbide. **Limits**—±.0002" ball bearing fit limit is held on one diameter. **Other limits** are ±.001". Total floor to floor time is 6 minutes against 50 minutes on a turret lathe—more than 8 times the production!

Check these Air-Gage Tracer Reports

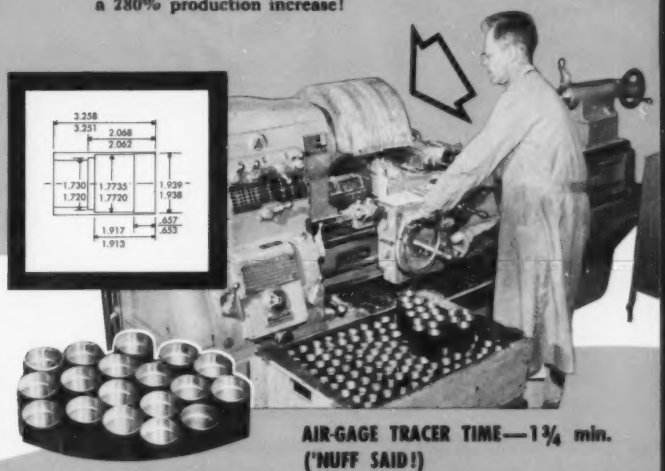


AIR-GAGE TRACER TIME—4¾ min.
OLD TIME—7 pieces per hr.

Part—Housing Cover. **Machine**—10" Model EE Air-Gage Tracer. **Material**—aluminum forging. **Operation**—turn, face and chamfer. **Limits**—portion of part which is faced held flat and parallel to opposite face within ±.001". Total floor to floor time is 4¾ minutes compared with production of 7 pieces per hour previously.

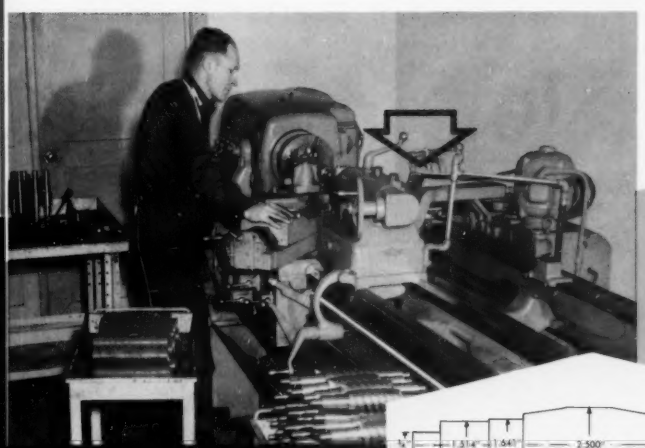
AIR-GAGE TRACER TIME—6.9 pieces per hr.
OLD TIME—1.8 pieces per hr.

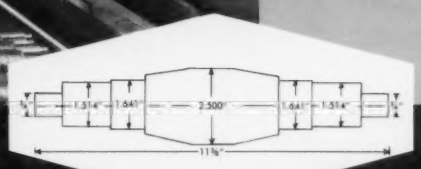
Part—Motor Shaft. **Machine**—16" Series 60 "Air-Gage Tracer." **Material**—SAE 1045 bar stock, 1-13/16" diameter x 25-13/16" length. **Operation**—turn complete. **Cutting tool**—carbide. A completely finished work piece (after all machining operations) is used as a round template. Previous to installation of "Air-Gage Tracer" 1.8 pieces were produced per hour, now 6.9 pieces are produced per hour—a 280% production increase!



AIR-GAGE TRACER TIME—1¾ min.
('NUFF SAID!)

Part—Motor Shell. **Machine**—13" Series 60 "Air-Gage Tracer." **Material**—seamless steel tubing. **Operation**—bore and internal face. Total floor to floor time is 1¾ minutes. This is another good example of the proficiency of the "Air-Gage Tracer" on bore operations. There are three bores of different dimensions and the material is seamless steel yet the operator turns the parts out without fear of spoilage and in the remarkably short floor to floor time of 1¾ minutes.





AIR-GAGE TRACER TIME—10 min. per piece
OLD TIME—60 min. per piece

Part—Worm Shaft. **Machine**—20" Series 60 "Air-Gage Tracer." **Material**—4340 steel. **Operation**—rough and finish turn complete. **Cutting tool**—carbide. Total floor to floor time is 10 minutes per piece compared with 1 hour required previously. Six times the production!

THE MONARCH MACHINE TOOL COMPANY, SIDNEY, OHIO

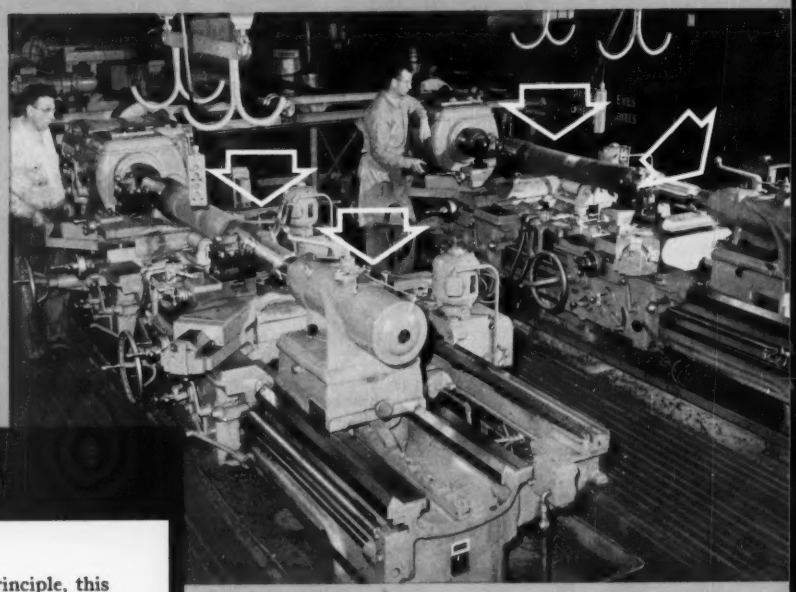
See Next Page for COUPON

TWO DOUBLE-HEADERS

double the output

AIR-GAGE TRACER TIME—7½ min.
OLD TIME—15 min.

Part—Anti-friction freight car axle. **Machine**—Monarch 25" x 120" Heavy Duty Lathe with dual carriages, each Air-Gage Tracer controlled. **Material**—A.I.S.I. C1040 steel forging. **Operation**—finish turn journals, journal dust guards and radii—both ends. **Limit**—±.001". Engine and center drive axle lathes with expensive form tools, previously used, presented difficulty in maintaining center distances of radii. Air-Gage Tracer turns journal O.D. and radii with desired accuracy, allowing plunge grinding without excessive grinding wheel breakdown, as before. And production is doubled!



ASK FOR INFORMATION!

Hydraulically operated, controlled on air-gaging principle, this is the most accurate duplicating device on the market. With tracer stylus operating on a pressure of only 5-6 ozs., change in template contour converts to corresponding tool position in thousandths of a second and movement of slide to control point repeats itself within a limit of .0001". It can be applied as factory equipment on all sizes of 10" to 32" machines, the Mona-Matic and Right Angle Lathes—exclusive swiveling type optional on most of them. With the Auto Cycle Unit, many Monarch Lathes with Air-Gage Tracer Controls become fully-automatic, high-production units. Air-Gage Tracer controlled lathes can be converted to or from manual control in seconds.

ENGINE LATHES—10" to 32"
TOOLMAKER'S LATHES—10" to 20"
THE MONA-MATIC—for high production metal turning
THE SPEEDI-MATIC—a fast, precision hand screw machine
THE MONARCH MOTOR-TRACE
THE MONARCH-KELLER TURNING MACHINE
THE MONARCH AIR-GAGE TRACER
THE MONARCH ROLL TURNING LATHES
THE MONARCH 60" RIGHT ANGLE LATHE
THE SHAPEMASTER ENGRAVER
SPECIAL TURNING MACHINES

THE MONARCH MACHINE TOOL COMPANY
SIDNEY, OHIO

Monarch
ACCURACY • ECONOMY • LONG LIFE
TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH

Gentlemen:

☐ I am interested in your Air-Gage Tracer story and would like to receive your illustrated Booklet, with complete data and job performance reports. Please send me your Booklet 2607 without obligation.

☐ Please have a Monarch sales engineer call on me.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

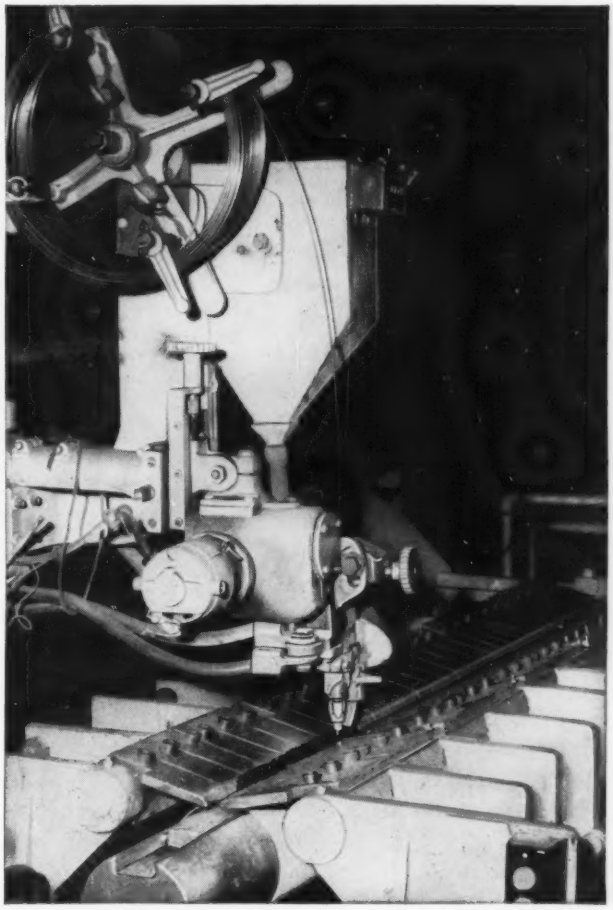
CUT *maintenance costs on tough welding jobs*

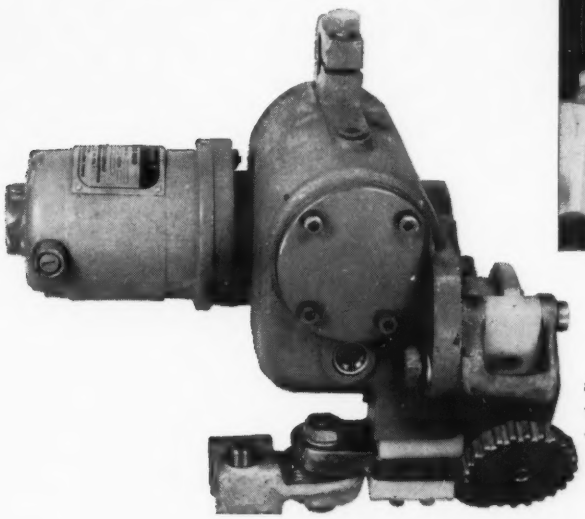
with the New UNIONMELT DSH *welding head*

Trade-Mark

Here's the low cost, submerged melt welding head that saves maintenance costs on tough welding operations. The new UNIONMELT DSH head combines the flexibility of the lighter units with the ruggedness needed in heavy-duty welding machines. Large, sturdy gears and bearings give long, trouble-free service though work may involve frequent starts and stops and feeding heavy electrode wire. Simple controls and mounting arrangements make the DSH head easy to operate and maintain.

UNIONMELT welding joins thin metals at speeds up to 200 in. per minute or makes one-pass welds with a 3-inch penetration if desired. If you have a production job in your plant that requires high-quality welds made at high speeds, ask your nearest LINDE Office today for more information about UNIONMELT welding. A LINDE Engineer will be glad to help you plan your UNIONMELT installation for high-speed, production welding.





With the new UNIONMELT DSH head now available in five output speeds, you can select the best unit you need for making high-quality low-cost welds at the highest welding speeds.

Linde Air Products Company

A Division of Union Carbide and Carbon Corporation

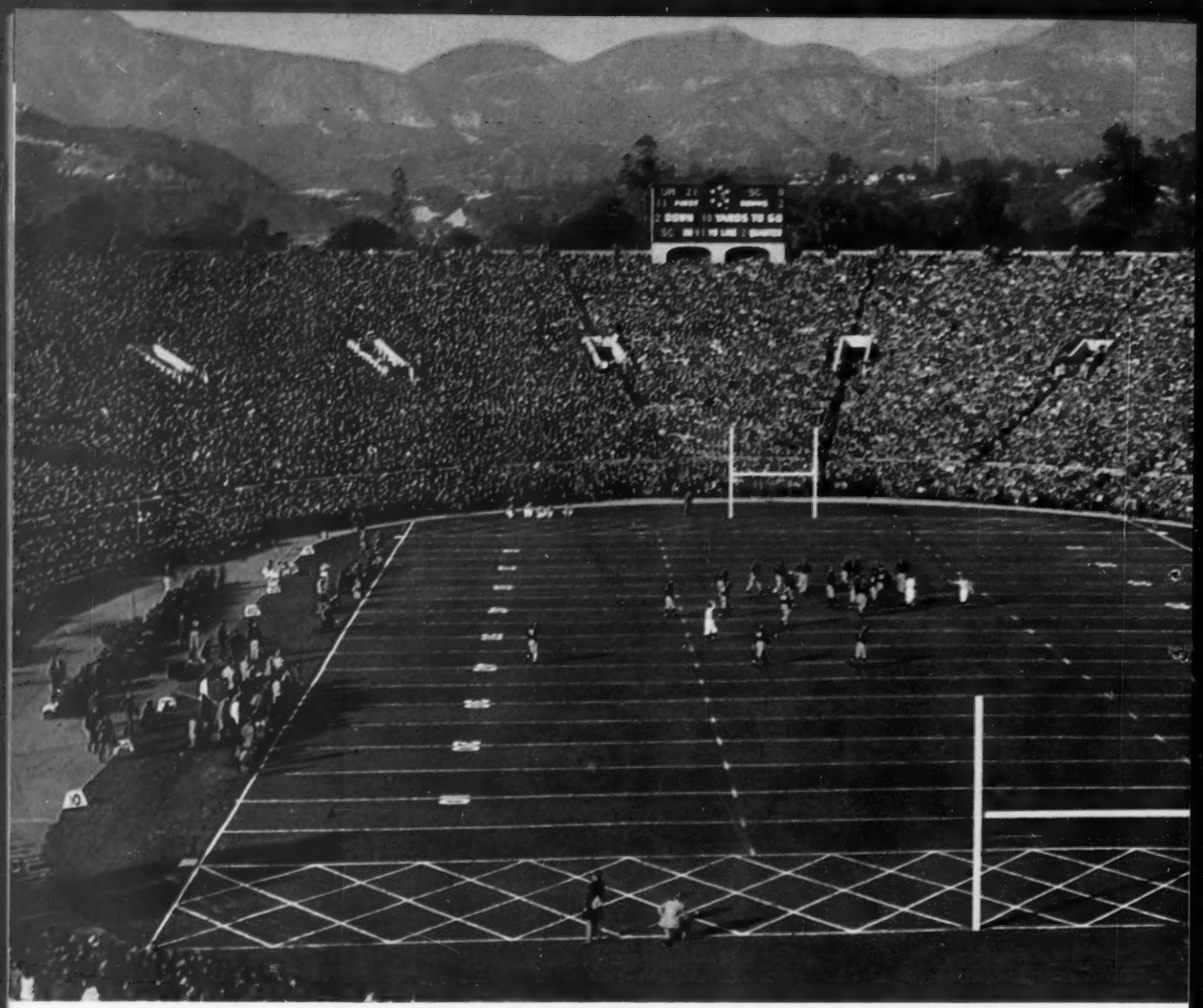
30 East 42nd Street UCC New York 17, N. Y.

Offices in Other Principal Cities
In Canada: DOMINION OXYGEN COMPANY
Division of Union Carbide Canada Limited, Toronto

The terms "Linde" and "Unionmelt" are registered trade-marks of Union Carbide and Carbon Corporation.

For more information on products advertised, use Inquiry Card, page 245

Linde
Trade-Mark



Rose Bowl, Pasadena, California

Shostal Press Agency Photo

BULLARD

The Invisible Background of Industrial Progress

Americans are sports-loving and sports-minded people. Our interests vary, as participants or spectators and include baseball, golf, football, soccer, hunting, fishing, hockey, skating, skiing and many others, too numerous to mention.

Likewise, modern industrial management realizes that improved employee morale, higher efficiency and better community relations are the result of employee recreation programs and warrant their support.

Manufacturers of sports equipment and supplies, builders of stadiums and indoor arenas are users of *Modern Machine Tools* — "The Invisible Background of Industrial Progress."

THE BULLARD COMPANY

Bullard Mult-Au-Matic
Type "D"–8"–12"–16"
with 6 or 8 Spindles.
Also 16–23"

A satisfied customer speaks from experience. The John Waldron Corporation of New Brunswick, New Jersey, manufacturers of a well-known line of precision couplings, have been users of Bullard Mult-Au-Matics for 28 years. Here is what they say:

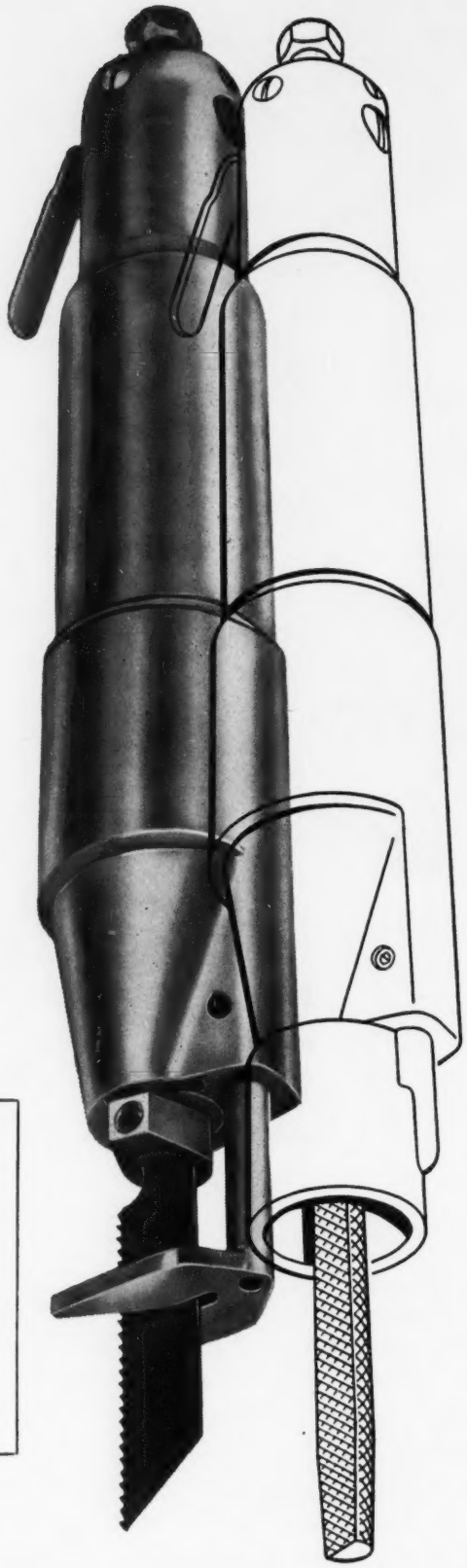
> "The close tolerances we obtain on our Mult-Au-Matics, regardless of age, will even surprise Bullard. Some of the diameter tolerances are as close as −.001″ +.000″. We have 100% inspection of every finished piece as well as of the assembled unit. We make absolutely sure that these tolerances are maintained.
>
> "Bullard Mult-Au-Matics give us the accuracy we need. I doubt whether any other machine can excel Bullard for continuity of performance — a "must" with rising material and other overhead costs."

These same advantages of precision performance and reliability can be applied to your machining problems *to reduce your costs.* Call your Bullard Sales Office or Distributor — there's one near you — or write to The Bullard Company, Bridgeport 2, Connecticut — phone EDison 6-2511 for complete information.

BRIDGEPORT 2, CONNECTICUT

NEW!

the double-duty CP Air Saw



IT CUTS AND FILES . . .

Stainless Steel, Dural Alloys, Nickel, Copper, Aluminum, Iron, Steel, Brass, Plastics, Plexiglass, Fiberglass, Porcelain, Formica, Corrugated Transite Sheeting, Wood, Plywood, Hard Fibre, Wall Board, Masonite.

The CP Air Saw is not an attachment . . . it's a heavy-duty production tool that can take standard blades and files. The Chicago Pneumatic Saw has CONTROLLABLE POWER . . . a built-in speed regulator enables you to select the right speed for every specific work condition. When fitted with the blade collet it can saw practically every material and cut most any possible shape . . . a file chuck can be added to power bench files having round or flat shanks. *Chicago Pneumatic Tool Co., 8 East 44th St., New York 17, N. Y.*

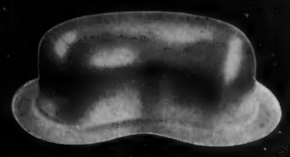
EXAMPLES OF ITS THOUSAND-AND-ONE USES

1. **In Receiving and Shipping** – for opening wooden boxes and crates.
2. **In the Shop** – for cutting through thin gauge metal without resulting warpage.
3. **In the Foundry** – for deburring castings.
4. **In the Automotive field** – for installing car heaters, radios and many other "extra" items.
5. **In the Electrical field** – for armature undercutting, cutting coils out of electric motors prior to rewinding, for filing burrs from stator slots in motors and generators.
6. **In Plant Maintenance Departments** – for blind sawing in duct and piping work.

Chicago Pneumatic

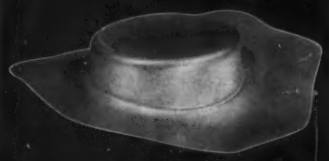
PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

For more information on products advertised, use Inquiry Card, page 245



One operation
0.064" 24SO Aluminum

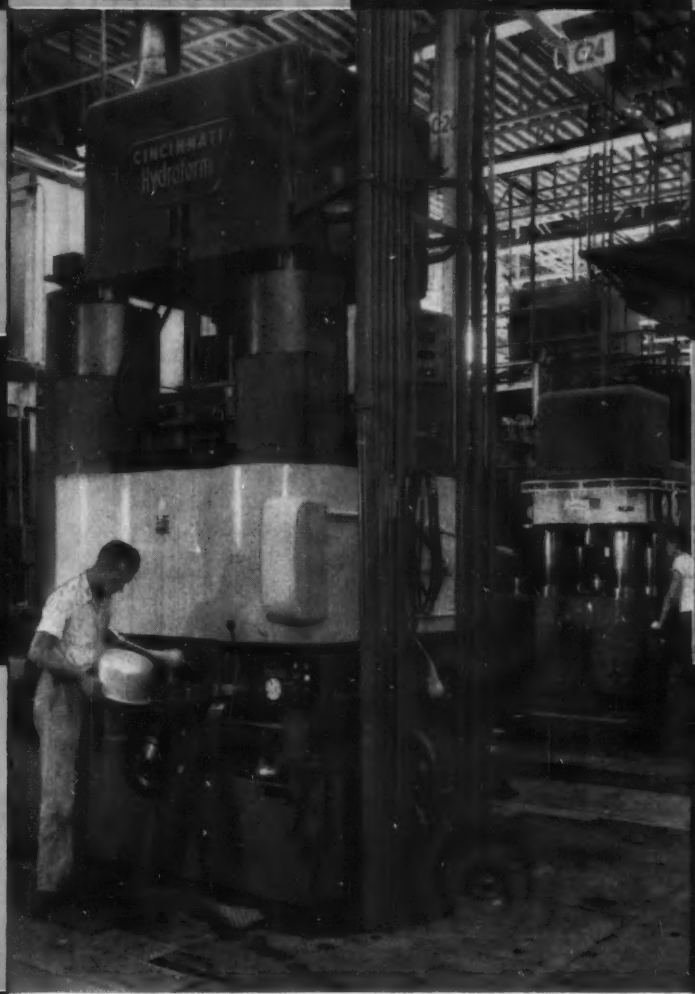
One operation
0.051" 24SO Aluminum



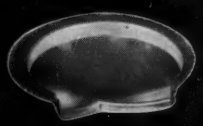
One operation
0.064" 61SO Aluminum

Drop Hammer combined with one Hydroform operation.
0.064" 61SO Aluminum

One operation
0.040" 75SO Aluminum



One operation
0.025" RC70 Titanium



One operation
0.051" 61SO Aluminum

◀CINCINNATI HYDROFORM MACHINES AT NORTH AMERICAN AVIATION, Inc. 26" machine in foreground, 12" machine in background. For a description of the Hydroforming process and specifications of the 8", 12", 19", 23", 26", and 32" machine sizes, write for Bulletin M-1759-1.

Two operations
0.040" 61SO Aluminum

Two operations
0.032" 52SO Aluminum

Three operations
0.032" 61SO Aluminum

These are typical aircraft components produced on two *Cincinnati Hydroform* machines at North American Aviation, Inc. Hydroforming has increased their overall production of intricately-shaped parts . . . made from all types of materials ranging from aluminum to titanium . . . at *very substantial savings* in development and production time, in tooling, material and labor costs.

To determine if Hydroforming can produce similar savings for your manufacturing program, call a Cincinnati Milling field engineer.

One operation
0.051" 61SO Aluminum

CINCINNATI

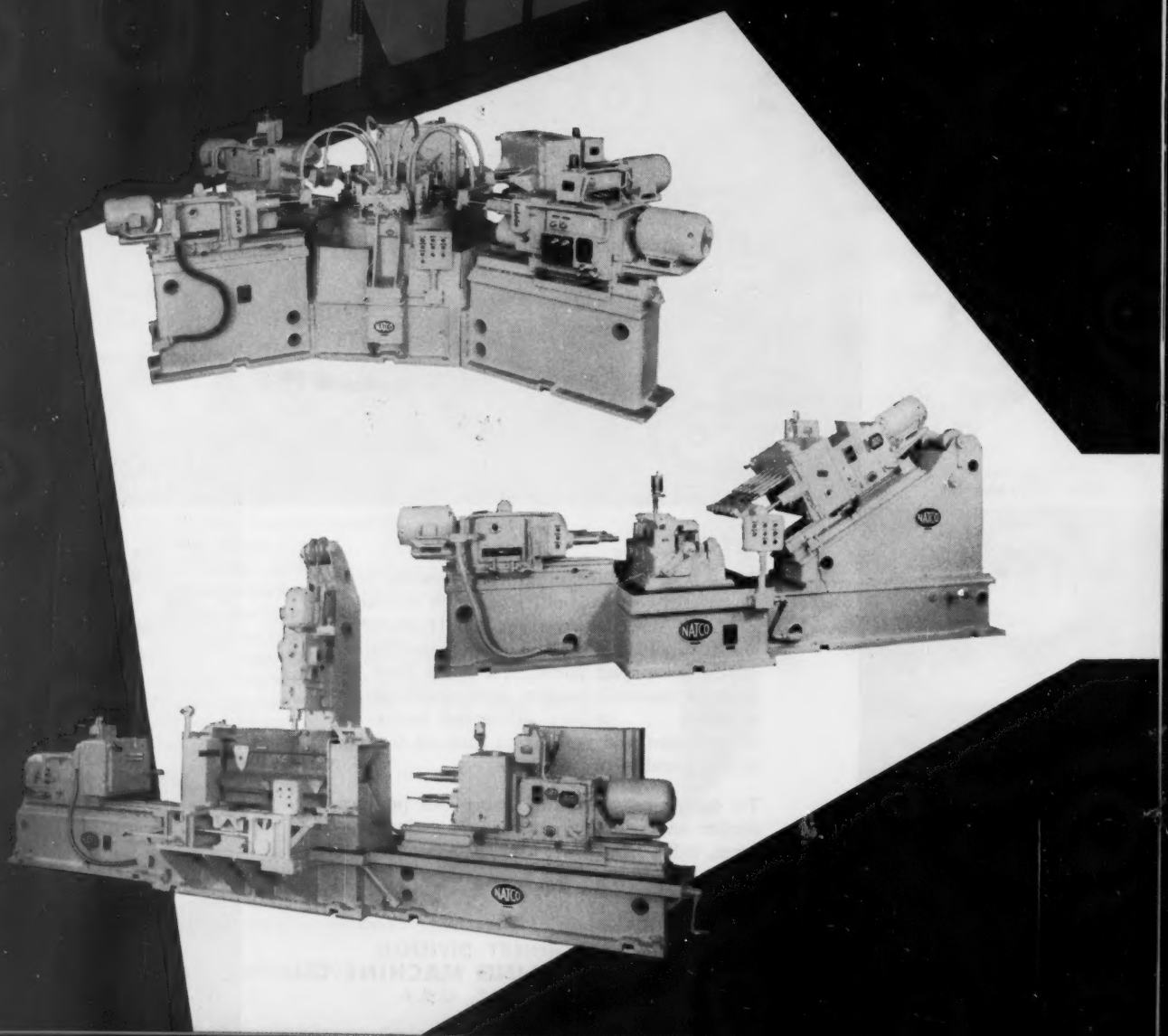
Hydroform

PROCESS MACHINERY DIVISION
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U.S.A.

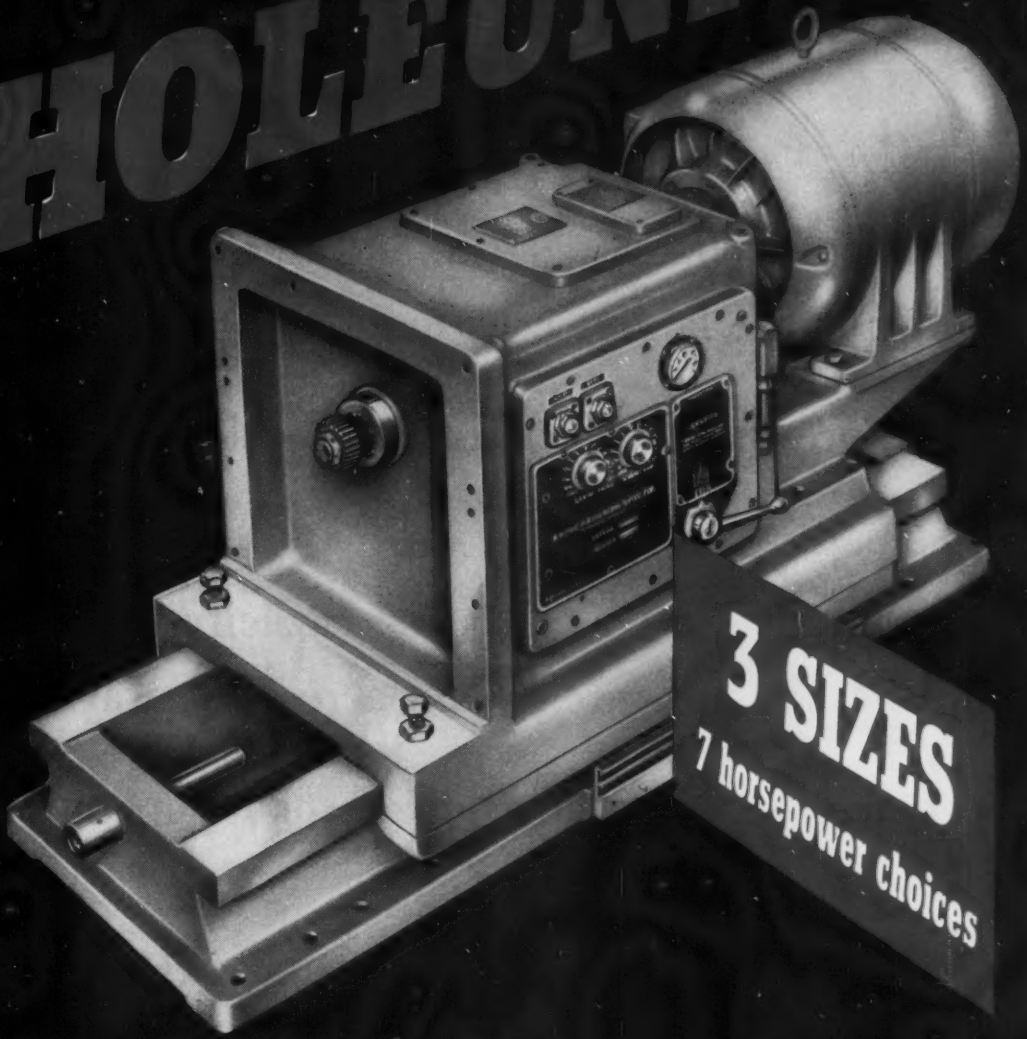
One operation
0.064" 61SO Aluminum

BUILD YOUR OWN DRILLING, BORING, FACING and TAPPING MACHINES WITH...

NATCO



HOLEUNITS



Shown at left are a few representative machines that have been built from NATCO Holeunits. These standard, compact, self-contained hydraulic units are furnished in three sizes and may be arranged with any one of seven different horsepower capacities ranging from one and one-half to fifteen horsepower. They will operate at any angle and no connections other than electrical are required.

Call a Natco Field Engineer

to help you solve your problems in
Drilling, Boring, Facing and Tapping

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Indiana

Branch Offices

CHICAGO, Room 203, 6429 W. North Ave., Oak Park • DETROIT, 10138 W. McNichols Rd.
BUFFALO, 1807 Elmwood Ave. • NEW YORK, 35 Beechwood Ave., Mount Vernon

BIGGEST!

This Betts 100 Inch Worm and Rack-driven Slotter is the largest ever built in America.

It is more than 30 feet high and weighs over 140 tons.

The table has a load carrying capacity of 75 tons and the bed measures 9 feet across the ways.

Seventeen motors are required for its operation.

CONSOLIDATED MACHINE TOOLS

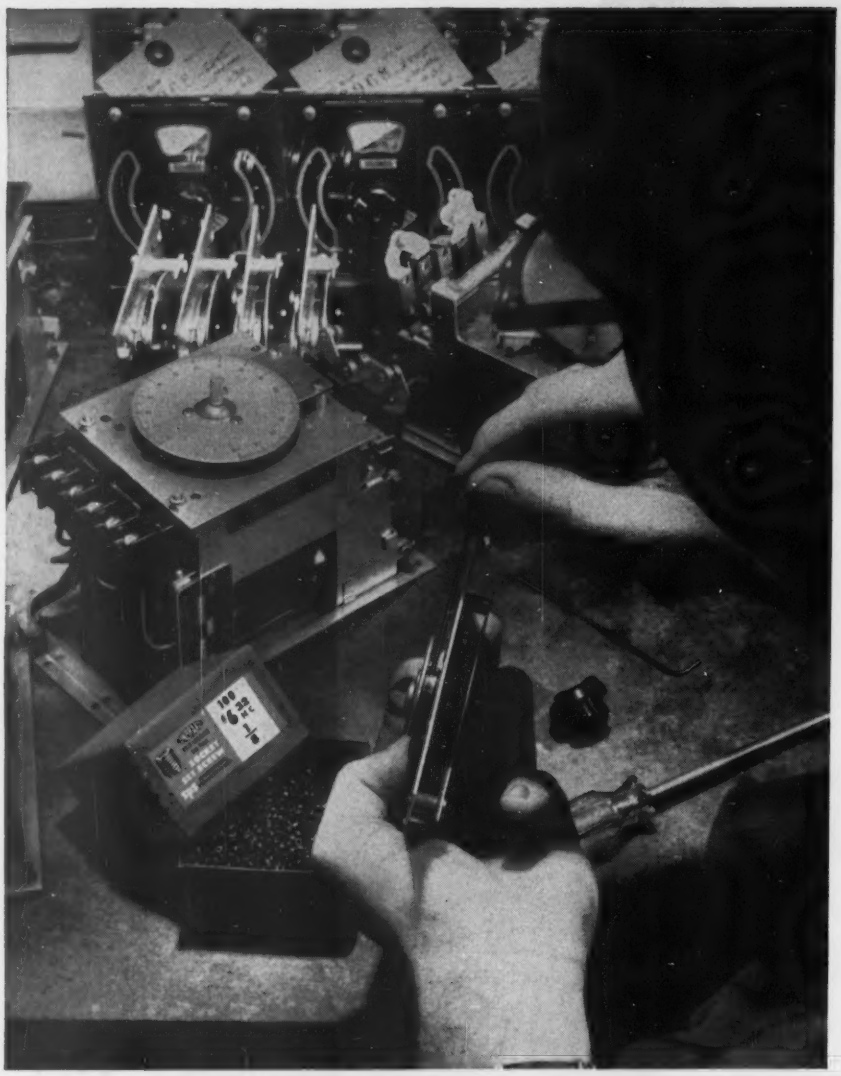
This big Betts Slotter has a reversing planer-type variable-voltage motor drive. All machine functions are push button controlled and the circular work table has General Electric ultra-precise electronic indexing.

CONSOLIDATED MACHINE TOOL

Wholly owned subsidiary of Farrel-

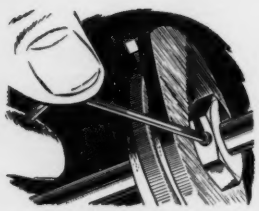
CORPORATION, ROCHESTER, N.Y.

Birmingham Company, Incorporated.



UNBRAKO Self-Locking Socket Set Screws are used to hold the Vernier-Set or Cycle-Progress cam on the shaft of this precision timing device. Once they are tightened, they maintain the accurate setting so important to the operation of the instrument.

Because they are so tiny, the UNBRAKO set screws are picked up and started in the tapped hole with the long arm key.



The compactness of the design of the timing device makes it necessary to turn the screw in prior to assembly. The uniform depth and size of the hex socket permit maximum torquing, speed assembly.

UNBRAKOs—made of heat treated alloy steel—have fully formed threads, Class 3 fit; have knurled cup point for positive locking. Are available in standard sizes from # 4 to 1".

You can lower your inventory by using UNBRAKO Standards—stocked by your distributor

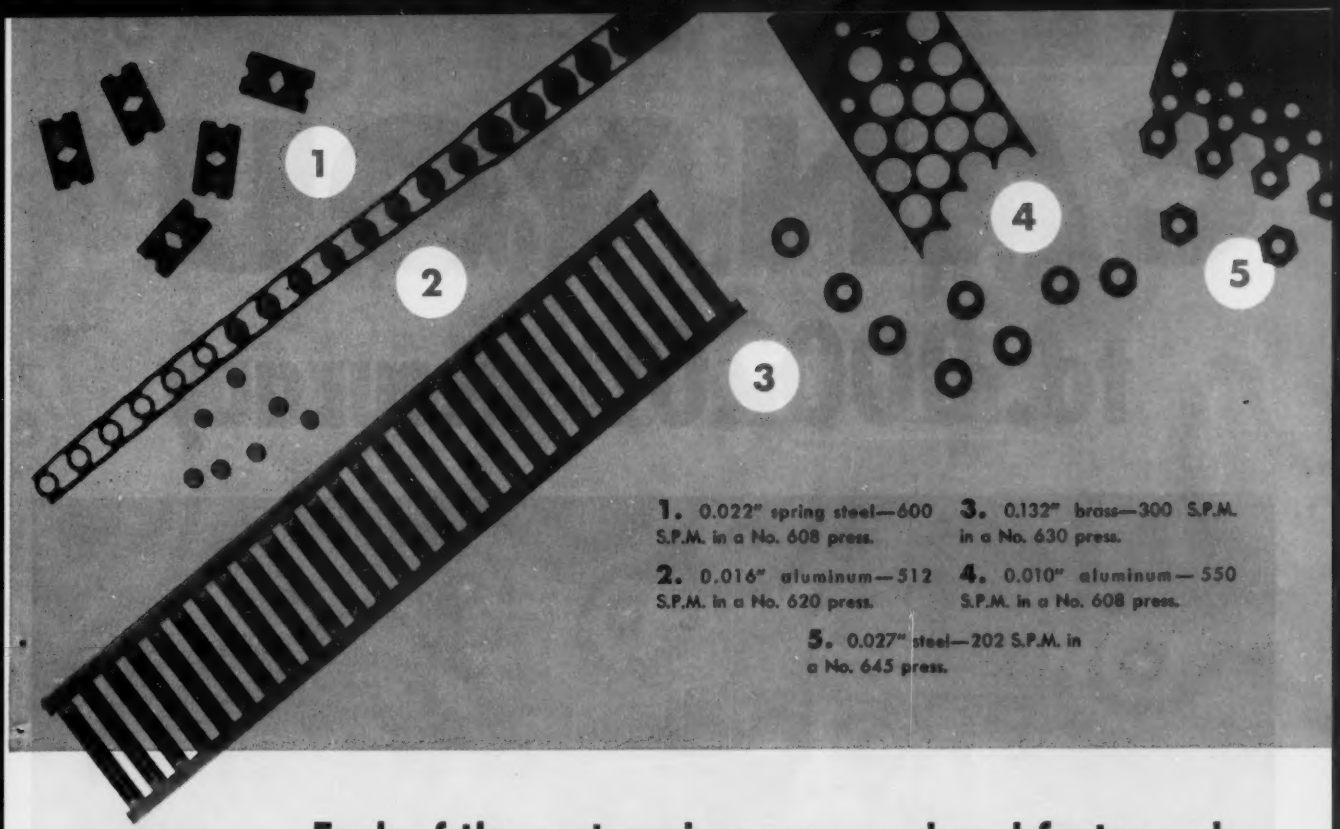
You'll have less money tied up in inventory, you'll get personalized service, faster deliveries. In addition, you'll reduce assembly time and increase production with these precision industrial threaded fasteners. Write for UNBRAKO Standards—a complete listing of socket screw products made by SPS and stocked by your local distributor. STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

UNBRAKO® SOCKET SCREW DIVISION

SPS JENKINTOWN PENNSYLVANIA

Flat Head Cap Screw | Shoulder Screw | Knurled Head Cap Screw | Dowel Pin | Button Head Socket Screw

For more information on products advertised, use Inquiry Card, page 243



1. 0.022" spring steel—600 S.P.M. in a No. 608 press.

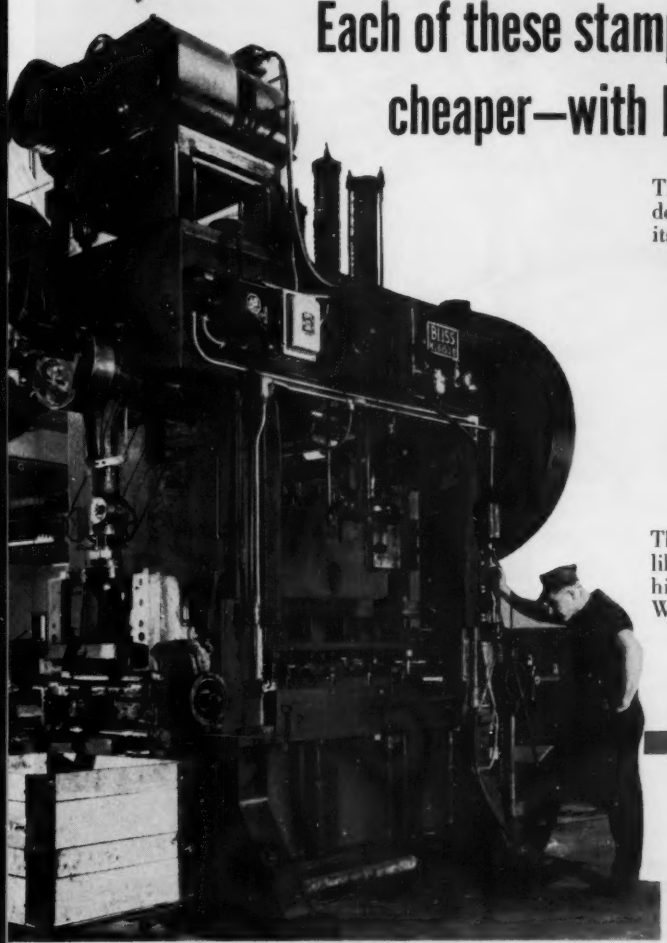
2. 0.016" aluminum—512 S.P.M. in a No. 620 press.

3. 0.132" brass—300 S.P.M. in a No. 630 press.

4. 0.010" aluminum—550 S.P.M. in a No. 608 press.

5. 0.027" steel—202 S.P.M. in a No. 645 press.

Each of these stampings was produced faster and cheaper—with BLISS High Production Presses



The Bliss 600 series of High Production Presses, especially designed and developed for high-speed stamping, has proved itself on America's faster production lines:

- At Lima Register—5 Bliss Automatic Presses replaced 65 hand-fed presses. Example of the unusual savings: floor register valve costs only 1/25th of a hand-fed stamping.
- At IBM—5 Bliss Automatic Presses are used for short run typewriter parts production—die changeover is so easy that production has been boosted "an estimated 25%".
- At Briggs & Stratton—350 magneto armature parts are turned out each minute—on one 620 Bliss High Production Press!

There's a Bliss bulletin which describes in detail examples like these—examples which may show how you can solve a high production problem of your own—with a Bliss press. Write for catalog 27-A today.

BLISS
SINCE 1857

is more than a name...it's a guarantee!

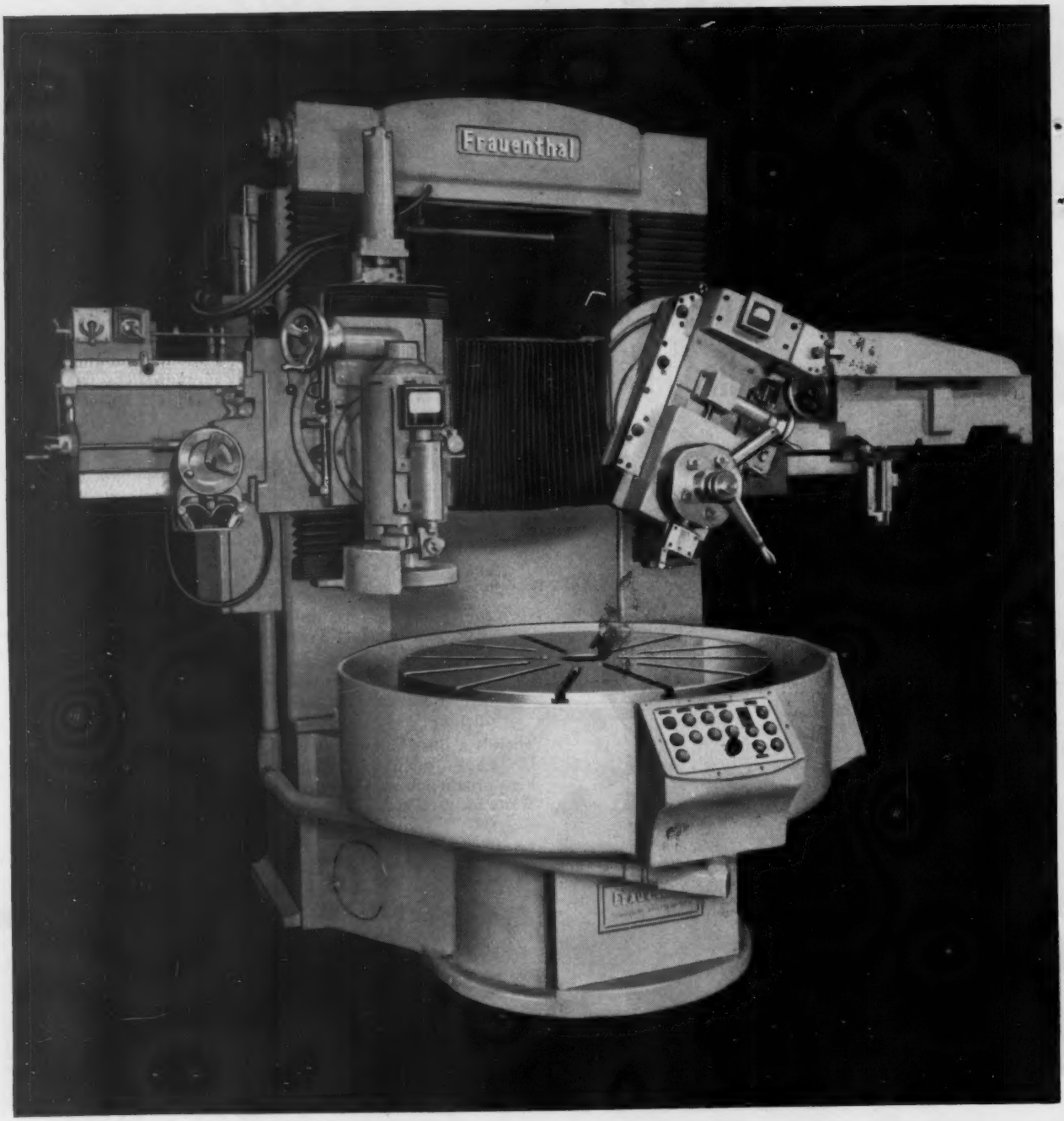
E. W. BLISS COMPANY, Canton, Ohio
PRESSES, ROLLING MILLS, SPECIAL MACHINERY

Subsidiary: The Die Supply Company, Cleveland, O. • E. W. Bliss (England) Ltd., Derby • E. W. Bliss Company (Paris) France

U. S. Plants in Canton, Salem and Toledo, Ohio; Hastings, Michigan; and San Jose, Calif. *Branch Offices* in Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, Toledo; and Toronto, Canada. *Other representatives throughout the world.*

CAN YOU

to .000200" accuracy



turn, bore and grind in a single set-up?

The Frauenthal 3100 Series offers this precision and versatility with these cost-cutting features

1. Utmost versatility — Both grinding compound and turret slide can be swiveled to meet practically any angular requirement.

2. Super-precision performance — Only a Frauenthal grinds related surfaces to accuracies within .000200", producing consistently uniform precision in concentricity, parallelism and roundness.

3. Horizontal table — Loads easier and faster than vertical face plates. Horizontal table also provides greater stability for large, heavy parts.

4. Simplified tooling — Horizontal table permits simpler fixtures, particularly for thin-section jet engine parts, plus economy of dual purpose tooling for turning and grinding.

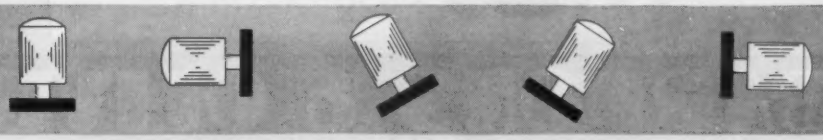
5. Convenient controls — All operating controls are easily within the operator's reach for quick selection of feeds and speeds. Electrical interlocks are provided for utmost safety.

6. Contour turning — Hydraulic duplicator attachment (turning head) performs tracer controlled turning operations most accurately and performs repetitive operations at lower cost.

May we help you?

If you'd like further information on how the 3100 Series precision turning and grinding machine can give you production and/or tool room advantages — our engineers are at your service. Write for informative bulletin No. 301.

Your choice of five positions of the grinding spindle



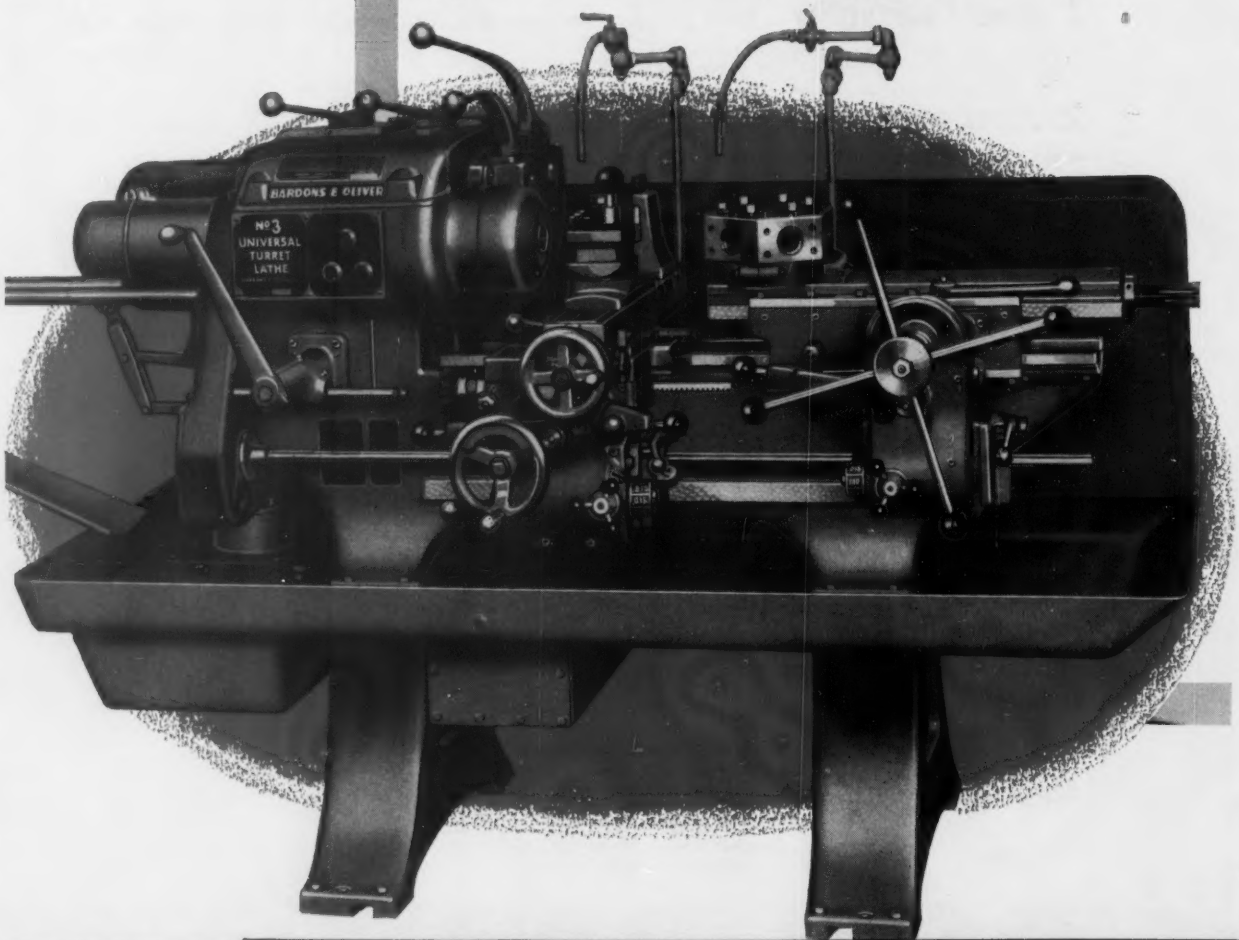
Frauenthal Division · KAYDON ENGINEERING CORP. · Muskegon, Michigan

New... BARDONS & OLIVER No. 3 TURRET LATHE...

★ 25% higher speed

★ 50% more power

★ 100% increased rigidity



BARDONS & OLIVER, INC.

1135 WEST 9TH STREET · CLEVELAND 13, OHIO

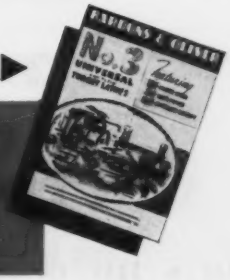
Featuring!

- √ 1825 R. P. M. Spindle Speed
- √ Unequaled Rigidity of "X" Type Cross Ribbing over Full Length of Bed
- √ 100% Anti-Friction Bearing Headstock
- √ Single Lever Feed Selectors for both the Hex Turret and Universal Carriage
- √ Alloy Bronze Anti-Backlash Nut on Cross Slide Screw
- √ "One-Shot" Lubrication of all Tool Slide Ways
- √ Flange Type Motor Mounting that Eliminates all Belts and Pulleys
- √ Hardened and Ground Steel Turret Slide and Saddle Ways, Gibs and Caps
- √ 7½ H. P. available at each one of 12 Geared Spindle Speeds
- √ Instantaneous High-Low Speed Change through Double Multi-Disc Clutch
- √ Replaceable Bed Ways of Solid Hardened and Ground Alloy Steel
- √ Large Hardened and Ground-in Thread Ball Bearing Cross Slide Screw
- √ Sealed Carriage and Saddle Aprons
- √ Improved Square Turret, Designed and Built for Lifetime Accuracy
- √ Impeller Type Coolant Pump with Individual Motor Drive
- √ Optional Collet Chuck Capacities (1½" or 2")

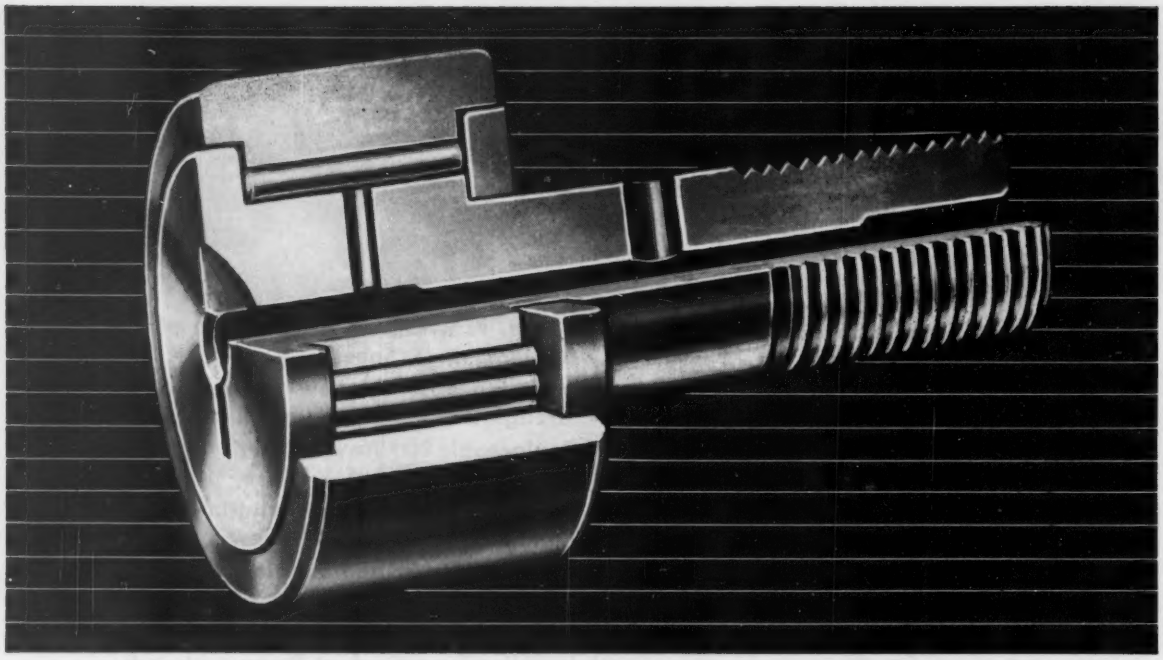
Specifications!

Swing Over Bed	15½ inches
Swing Over Guides	13¾ inches
Swing Over Cross Slide	7⅝ inches
Collet Chuck Capacity	1½ or 2 inch round
Hexagon Turret Travel	10 inches
Cross Slide Travel	9 inches
Carriage Longitudinal Travel	18½ inches
Turret and Carriage Power Feeds with Single Lever	6
Number of Speeds with Single Speed Motor	12
Motor Horse Power	7½
Net Weight With Cabinet Motor	3050 pounds
Net Weight With Flange Motor	2850 pounds

SEND FOR NEW NO. 3 CATALOG ▶

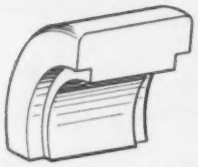


MANUFACTURERS OF A COMPLETE LINE OF
TURRET LATHES AND CUTTING OFF LATHES



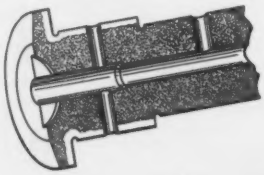
TORRINGTON CAM FOLLOWERS

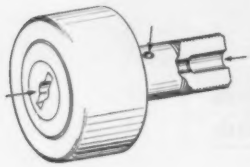
Give Longer Service... Carry High Shock Loads



1. Heavy sectioned outer race of hardened and ground high carbon chrome steel assures uniform distribution of high rolling and shock loads while providing high capacity anti-friction performance.

2. Integral stud for cantilever mounting is made of case hardened and ground low carbon nickel molybdenum steel. The tough core provides high strength to withstand high shock loads.

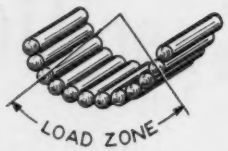


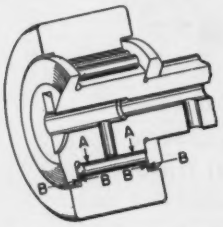


3. Easily relubricated at any one of three points—at either end or through cross hole in stud. Ends accommodate standard drive grease fittings, or may be sealed by the plugs provided.

District Offices and Distributors in Principal Cities of United States and Canada

4. Full complement of small diameter rollers—through-hardened, ground and lapped—for maximum radial load capacity.





5. Raceways precision ground for even load distribution (A) and uniform low end play (B) assure long bearing life.

Torrington Cam Followers are precision made throughout. They are available in sizes from ½" to 2¼" O.D. Special surface finishes such as chrome and cadmium plate or oxide black can be provided.

Our Engineering Department will be glad to work with you in adapting these dependable and efficient Cam Followers to your cam-controlled or track-type equipment. Torrington Cam Followers give better service because they're better made.

THE TORRINGTON COMPANY

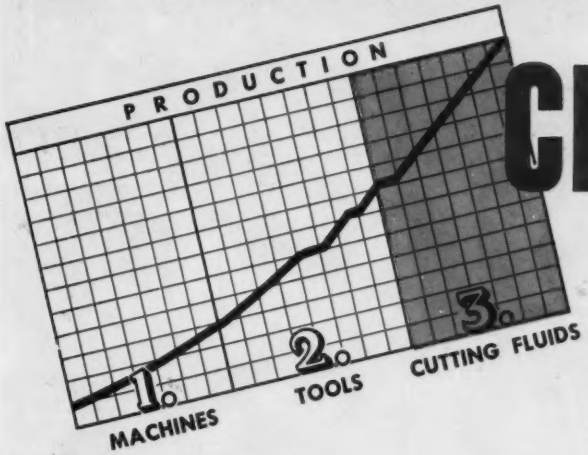
Torrington, Conn. **South Bend 21, Ind.**

TORRINGTON *NEEDLE* **BEARINGS**

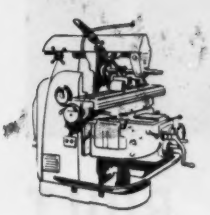
Needle • Spherical Roller • Tapered Roller • Cylindrical Roller • Ball • Needle Rollers

For more information on products advertised, use Inquiry Card, page 245

For maximum efficiency...

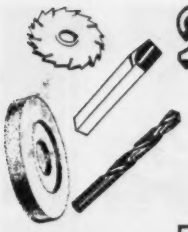


CHECK ALL THREE!



1 MACHINES

Several machines in your plant may be capable of performing the job at hand. You may consider two or three machines or even make test runs before deciding which is best. DO *YOU* ALSO CHECK SEVERAL CUTTING FLUIDS?



2 TOOLS

Carbon steel tools may do the job— but you don't hesitate to try high speed steel or carbide tools if there is a chance they can do better. DO *YOU* ALSO CHECK SEVERAL CUTTING FLUIDS?

3 CUTTING FLUIDS

CHECK SHEAR-SPEED Soluble Oil against your present cutting fluids and convince yourself of its amazing advantages and versatility . . . *a multi-viscosity blend* for widest range of application. It's SEVERAL CUTTING FLUIDS ALL IN ONE. Avoids gumming characteristics of paraffin oils and corrosion or staining from sulfur and chlorine additives. Sold only on a satisfaction guaranteed test basis. Write today for Bulletin SO-53 and price list.

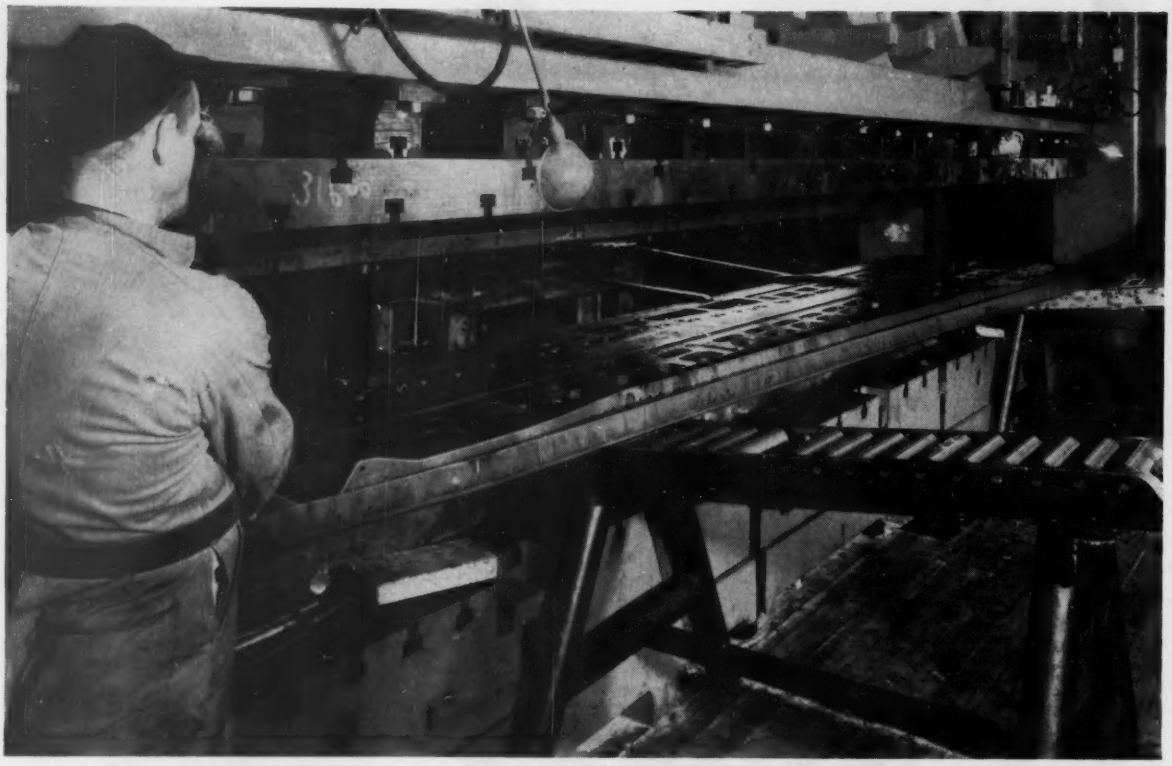
NEW COOLANT-LUBRICANT BOOSTS TOOL LIFE 60-80% IN PRODUCTION TESTS

Impartial tests of three cutting fluids conducted in the plant of a large auto manufacturer showed an increase in tool life of 60.5% and 81.6% for the new SHEAR-SPEED Soluble Oil over two other highly rated cutting fluids. Improved surface finish and reduced down-time were clearly demonstrated in the tests with unusually uniform results obtained during all runs with SHEAR-SPEED.

On this high speed hobbing operation turning out automotive gears SHEAR-SPEED Soluble Oil averaged 18% more gears cut per tool grind than the next best cutting fluid, with 35% less tool stock removed in sharpening. All variables including coolant flow, tool grinding, cutting speed, gear steel, etc. were maintained constant during test runs. Lower tool cost and increased production

SHEAR-SPEED
CHEMICAL PRODUCTS

7125 E. McNICHOLS RD. *A Division of Michigan Tool Co.* DETROIT 12, MICH.



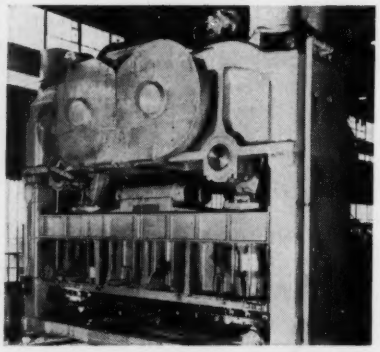
LARGEST MECHANICAL PRESS EVER BUILT

New Hamilton 4000 ton capacity press, in which there is no relative deflection in bed and slide, forms side rails that are perfectly straight

This Hamilton Side Rail Press was placed in production last winter in the Cleveland Plant of Midland Steel Products Company. It is an enormous machine, weighing 900 tons, which in itself is newsworthy. However, the outstanding feature is its ability, when loaded to 4000 tons pressure (its nominal capacity) to form perfectly straight side rails, without camber or "bow." This eliminates the subsequent straightening operation which has been the accepted customary practice in chassis frame manufacture.

OTHER "HIGHLIGHTS" OF THIS 4000 TON HAMILTON PRESS

- The bed is equipped with six 42-inch diameter air cushions providing 415 tons pad-pressure with air at 100 psi.
- The cushions are linked together and the operating valves are controlled by one pilot valve so that the six cushions function as a unit at all times.
- Overall height 44 feet with topmost point 30 feet above floor.
- 320 inch clear space between the uprights and gibs; shut height on bed 40 inches.
- Stroke of slide 22 inches; adjustment 12 inches.
- Drive motor 150 hp; slide adjusting motor 25 hp.



NEW HAMILTON PRESS at Midland Steel Products Company, Cleveland, Ohio is shown at top forming perfectly straight 22 ft. side rails of ⅜-in. steel without camber or "bow."

HAMILTON PRESS DIVISION
Baldwin-Lima-Hamilton Corporation
Curtis Building
Detroit 2, Michigan

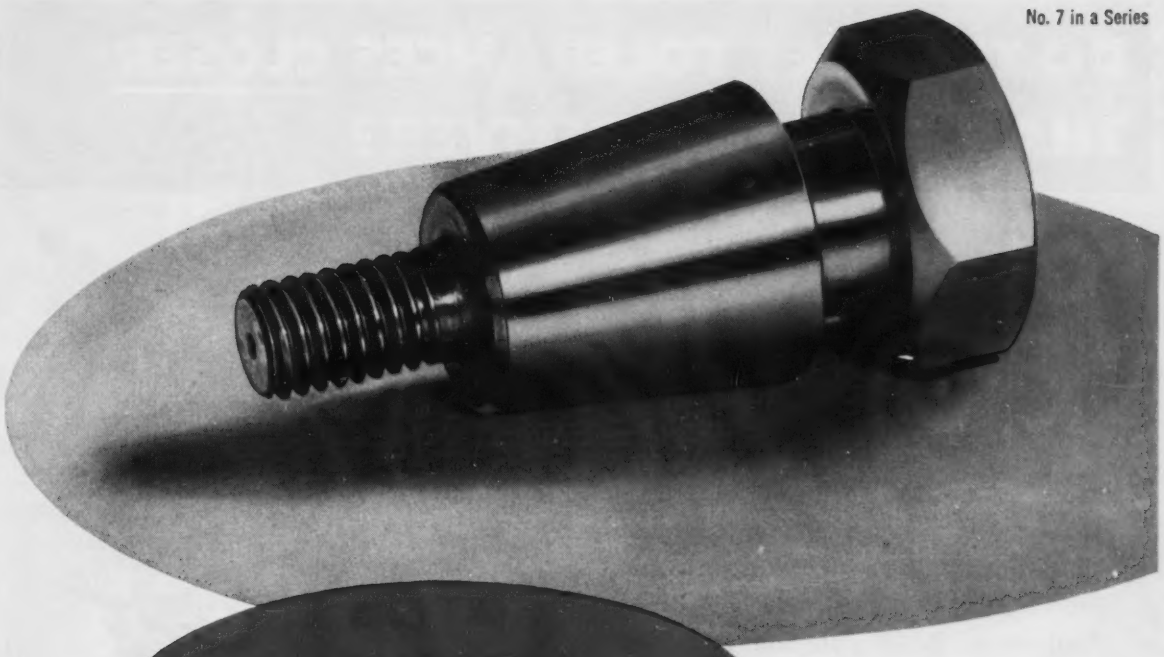
BALDWIN · BLH · LIMA-HAMILTON

BALDWIN-LIMA-HAMILTON

Branch Offices: New York · Chicago · Factory: Hamilton, Ohio

For more information on products advertised, use Inquiry Card, page 245

No. 7 in a Series



carbide service available

data for comparison

Part	Petcock Center
Machine	1⅝" Six Conomatic
Tools	100% Carbide Tipped
Material	X-1112
Stock Size	1" Hexagon
R. P. M.	1562
Time	8 seconds

Where conditions are favorable, 100% carbide tool-ups on "Automatics" make HSS tools appear as obsolete as ancient tools of carbon steel.

In determining the "favorable" conditions, the Conomatic Carbide Development is of real service to the "Automatic" user. Without risk of production loss or obligation of machine purchase, he gets an eye-witness demonstration of the profit possibilities of 100% carbide tooling to his own work.

Conomatic } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

DO THEY SET TOLERANCES CLOSER THAN YOU CAN DELIVER?

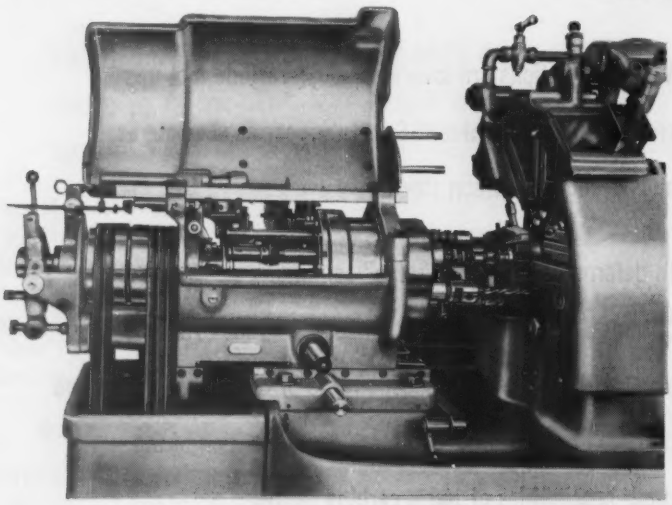
GET A

BECHLER
SWISS AUTOMATIC

Job sheets are specifying closer tolerances all the time. With Bechler Swiss automatics you can turn workpieces to within tenths. Furthermore, Bechlers are built in 2 different models—the latest with drum-turret is made in 3 sizes, the standard in 4—so you can get the one that fits your production needs (in short, you don't have to buy more machine than you want).

Bechler standard Swiss automatic—5 single-point tools for turning pins, staffs, arbors, shafts, pinions, and studs. Comes in 4 sizes with diameter capacities from 1/32" to 1 1/4". Maximum turning length is 9".

Stainless steel shaft 3/8" dia., 2 3/4" long, diameters held to .0003", concentricity .0005", finish 16 micro inch.



Bechler drum-turret Swiss automatic—12 work stations include 5 cross tools, 6 turret positions, and 1 pick-up position. For machining hubs, fittings, valves, housings, couplings, nozzles or other intricate precision parts with multiple end operations including internal and external threading. Comes in 3 sizes with diameter capacities from 1/32" to 1 1/4". Maximum turning length is 9".

- Service centers in New York and Los Angeles—factory trained men will plan layouts, produce tools, cams, and make set-ups.
- Complete stock of attachments, spare parts, and cams.

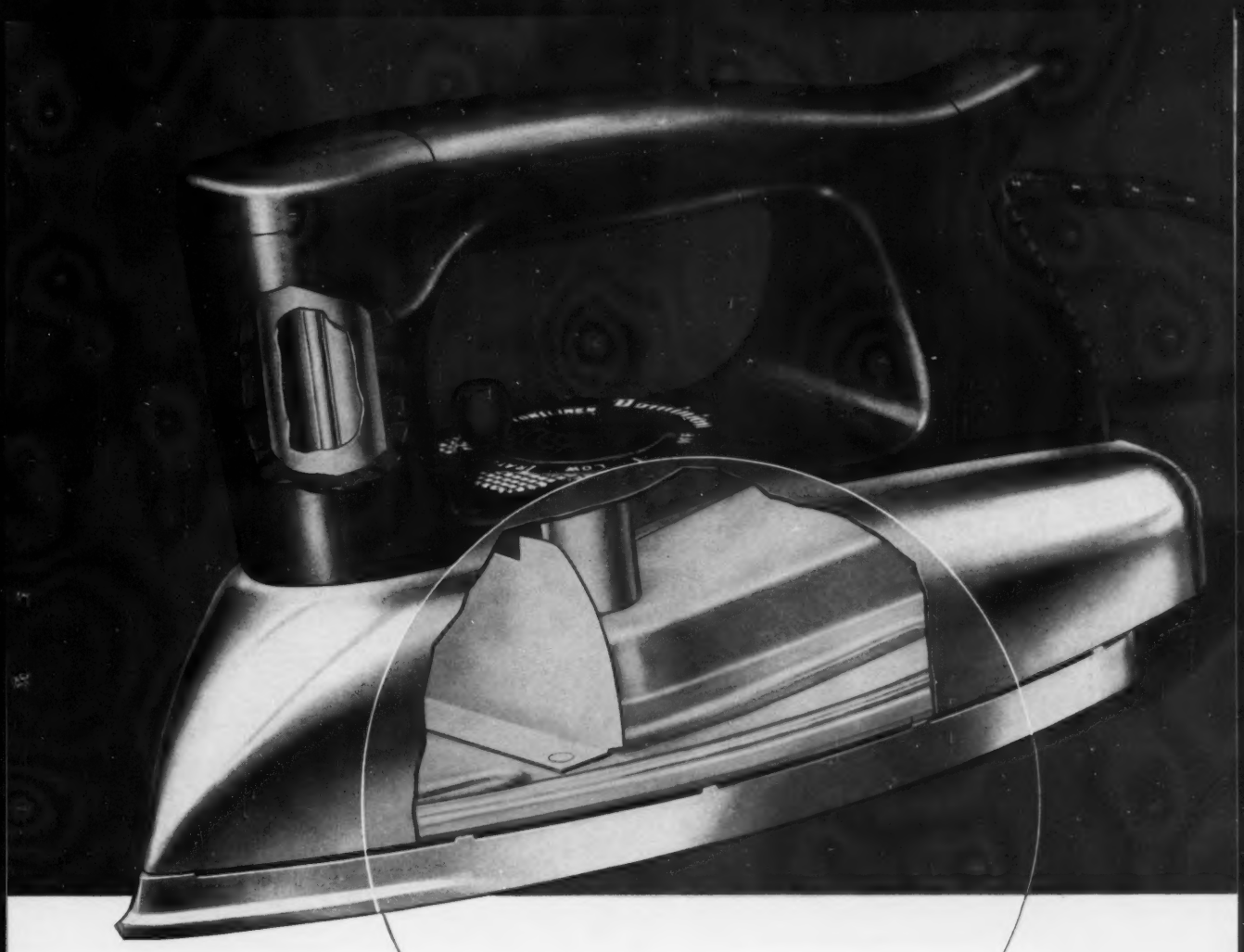
Enlarged cross-section of a nozzle: 3/8" dia., 3/4" long, three holes of different sizes, internal and external thread, and knurl.

Let us recommend the right Bechler for your precision job. Or, write for bulletin.

COSA — *nationwide sales and service of precision machine tools —from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

For more information on products advertised, use Inquiry Card, page 245



Peek under this gleaming chromium plate

and see functional, durable, BRASS at work

In adding a combination steam-and-dry iron to its list of electrical appliances, The Dominion Electric Corp., Mansfield, Ohio, set its goals high. The iron had to be engineered, styled and priced so as to be readily salable in a highly competitive market.

1 Costs *must* be kept down – without sacrificing quality.

2 The iron *must* be light in weight (actually 3¼ lb.) and provide a long service life.

3 It *must* operate unfailingly – anywhere – on ordinary, undistilled tap water.

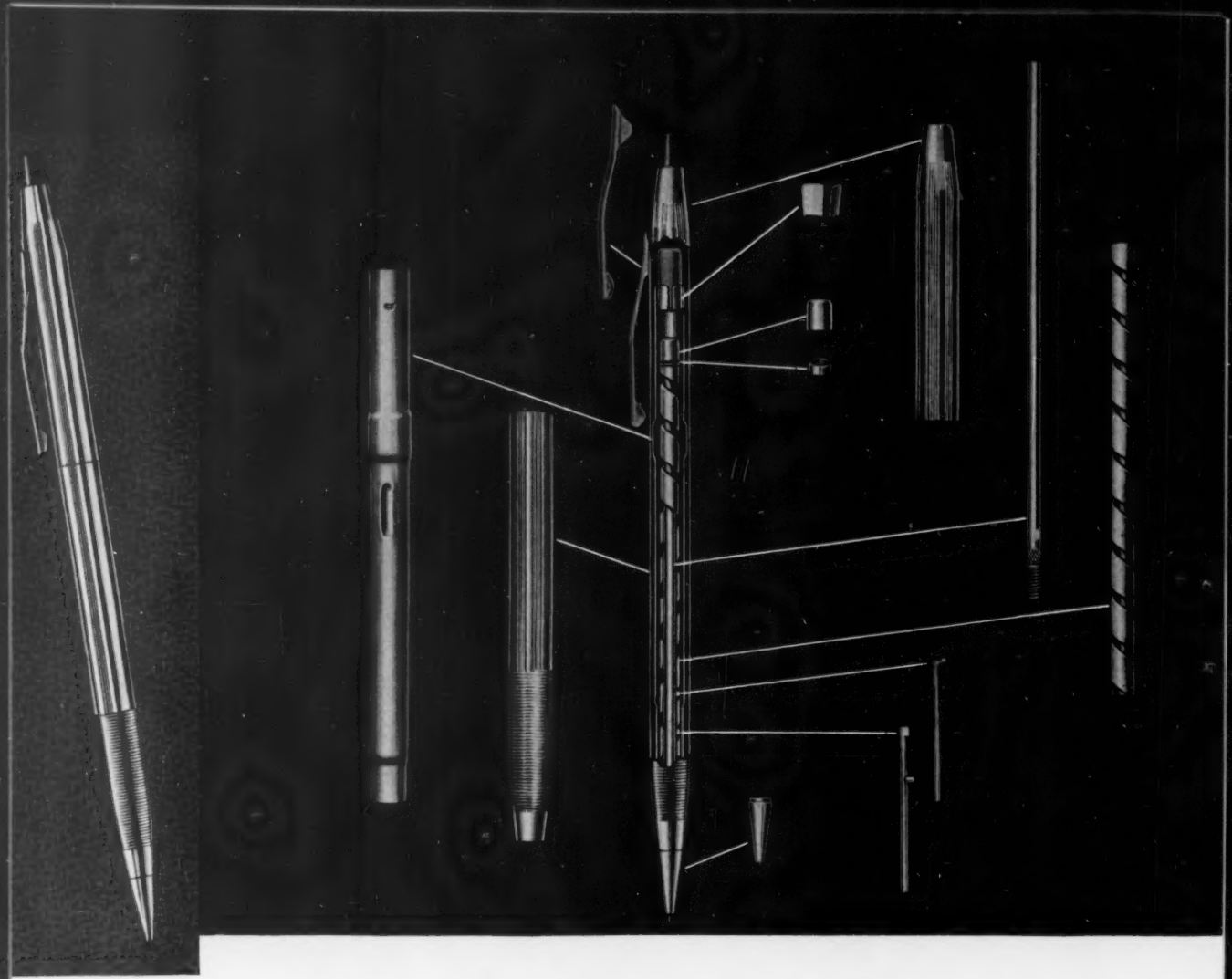
For the housing, steam generator, filler tube and miscellaneous supporting members, BRASS was the answer – as it so often is where freedom from rust, resistance to corrosion, workability and ease-of-finishing must be coupled with moderate cost.

We are glad to report that Dominion's choice and extensive use of Anaconda Brass paid off handsomely; also that we were able to give their engineering and production staffs an assist in selecting the right compositions and the most economical gages and tempers. Perhaps we can do the same for you? Simply write The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 3489

ANACONDA

the name to remember in

COPPER • BRASS • BRONZE



CROSS put an end to automatic pencil troubles **with BRASS**

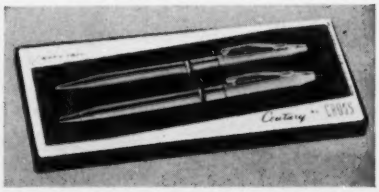
Since 'way back in 1846, America's oldest manufacturer of fine writing instruments—the A. T. Cross Pencil Company, Providence, R. I.—found out that you can do things with brass that you can't do with any other metal. And they've been doing it ever since.

Illustrated above in actual size are an even dozen parts that make up the chromium plated Cross Pencil. All, except the spring clip of phosphor bronze, are made of brass supplied as sheet, strip, wire, rod or tube.

Note the multiplicity of fabricating operations—from the free cutting brass point to the strip-wound spiral—and you'll come to the conclusion that brass gives you the most "easy workability" for your money.

And the man who owns a Cross Pencil—or Pen—is far less apt to fume or fuss. He's got a writing instrument that's tops in quality at a moderate price, with parts that resist wear and corrosion . . . that won't rust, gall or "freeze."

Dependable brass is plentiful—and unrestricted. The days of substitutes are over. Next time the man at the drawing board looks up and says "What'll it be," say "Make it brass." Better yet, say "Anaconda Brass." The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.



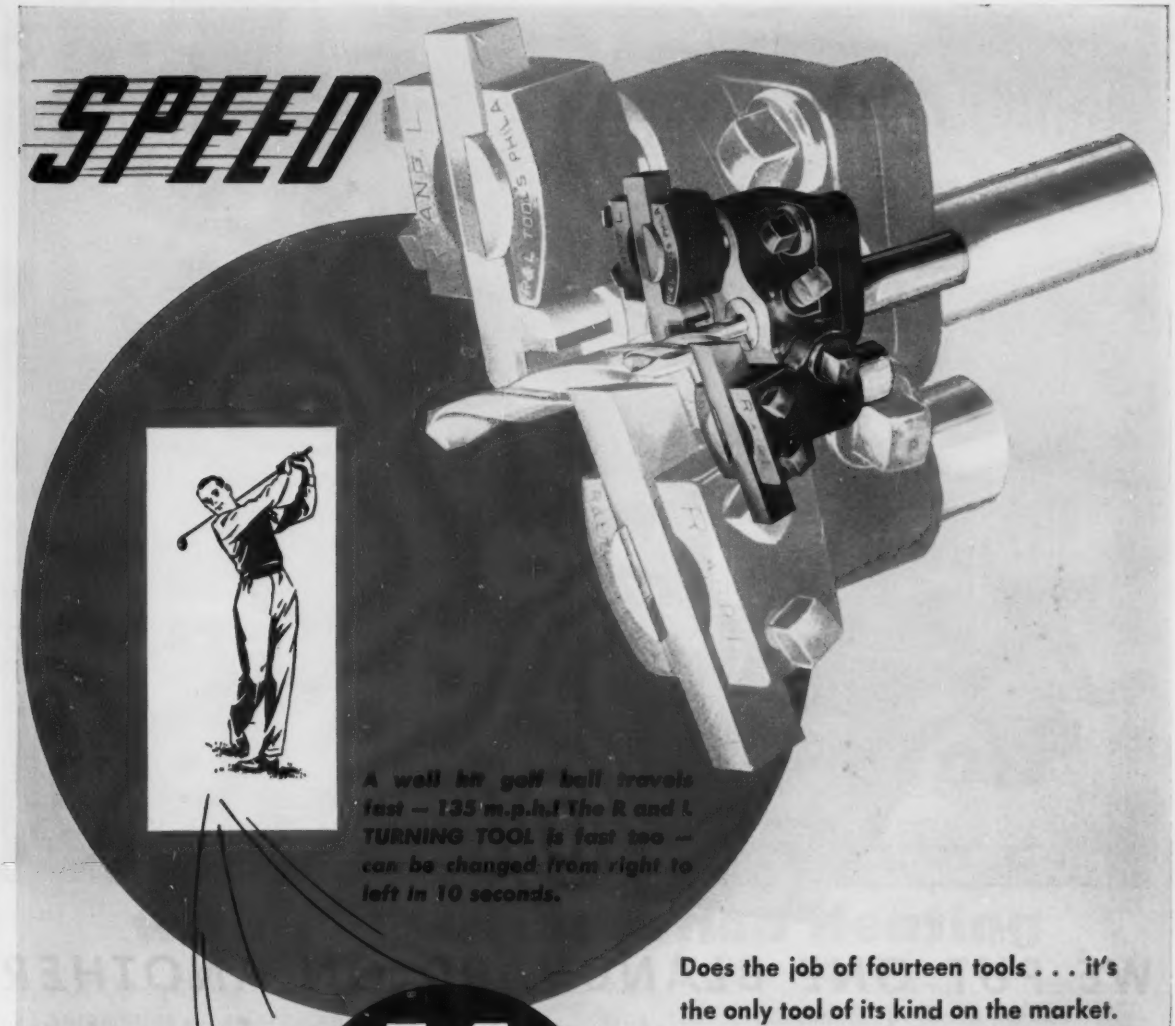
In the exploded view, above, is featured the pencil of the A. T. Cross Chromium Plated Pen and Pencil Set. All parts, including those in the pen, are made of Anaconda Alloys supplied by The American Brass Company since 1913. Cross also uses the same "inside working parts" in two "Century" Pen and Pencil Sets in which the caps, barrels and clips are available in either sterling silver or 1/20 12K gold-filled (illustrated above).

ANACONDA

the name to remember in

COPPER • BRASS • BRONZE

SPEED



A well hit golf ball travels fast — 135 m.p.h.! The R and L TURNING TOOL is fast too — can be changed from right to left in 10 seconds.

14 TOOLS IN ONE

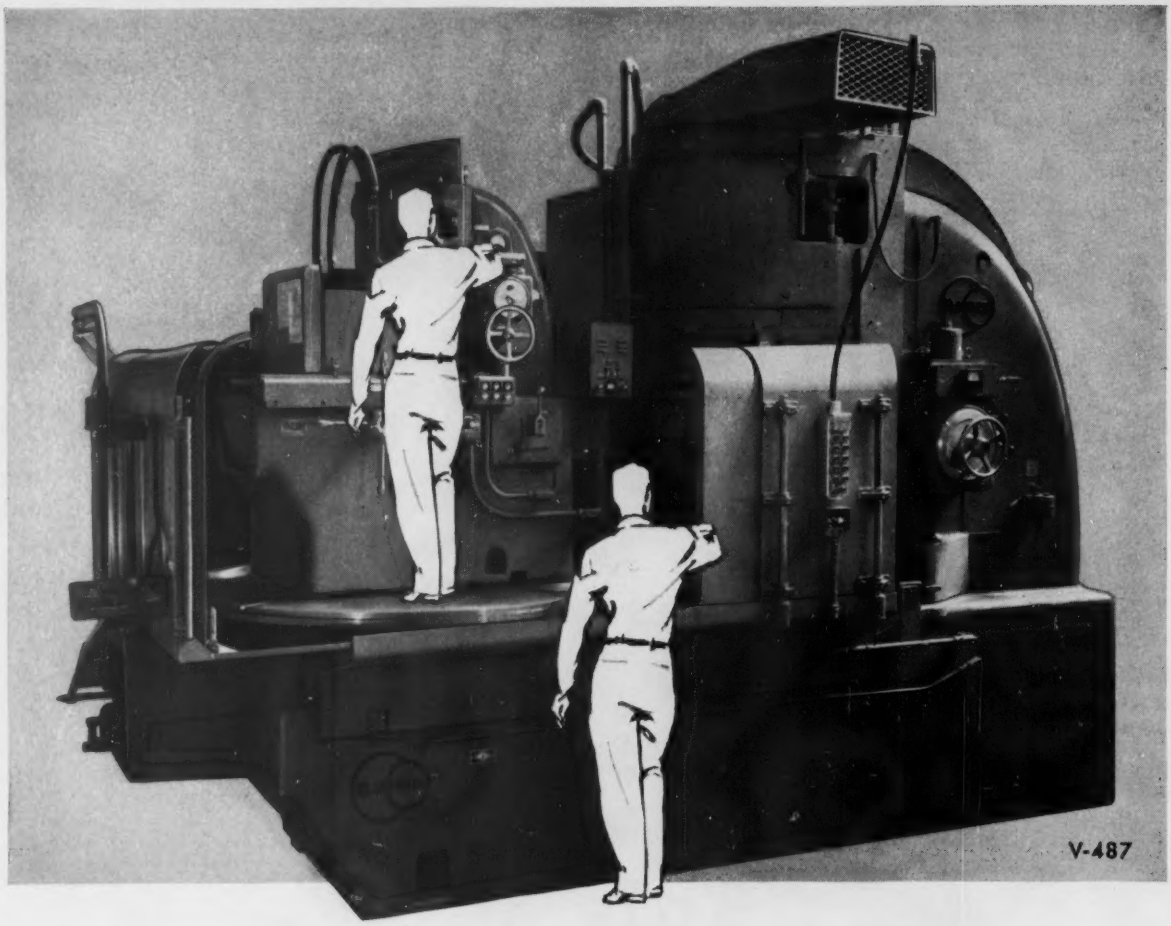
Does the job of fourteen tools . . . it's the only tool of its kind on the market. Drilling and turning; turning; centering and burnishing; pointing and form turning; drilling and chamfering; pointing . . . The R and L TURNING TOOL performs all these jobs. It is constructed of tough, heat-treated alloy steel . . . guaranteed not to bend or give way.

Write for Catalog

RIGHT R and L LEFT TOOLS

1825 BRISTOL STREET • PHILADELPHIA 40, PA.

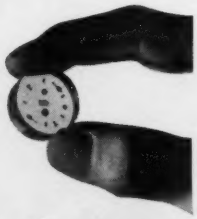
TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS (ALSO AVAILABLE FOR ACORN DIES) • UNIVERSAL TOOL POST • TURRET BACKREST HOLDER • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL



WE PUT ONE BLANCHARD ON ANOTHER

. . . to show you the wide range of sizes!

It's true! There's no "trick" photography involved. Our 5,400-lb. No. 11 Blanchard Surface Grinder fits snugly on the 84" chuck of our giant 61,000-lb. No. 42-84. And, like all Blanchards, both have chucks flat within .0002"—guaranteed!



Do every surface grinding job in your shop *perfectly* . . . whether you grind tiny watch parts—steel plates 7 feet across corners—or anything in between . . . *put it on a Blanchard.*

Whatever your requirements for stock removal, tolerances or surface finish, ask for details on the 15 standard Blanchard models today. One of them will fill your needs perfectly and will do your work with speed and precision—at costs which help you set competitive prices.

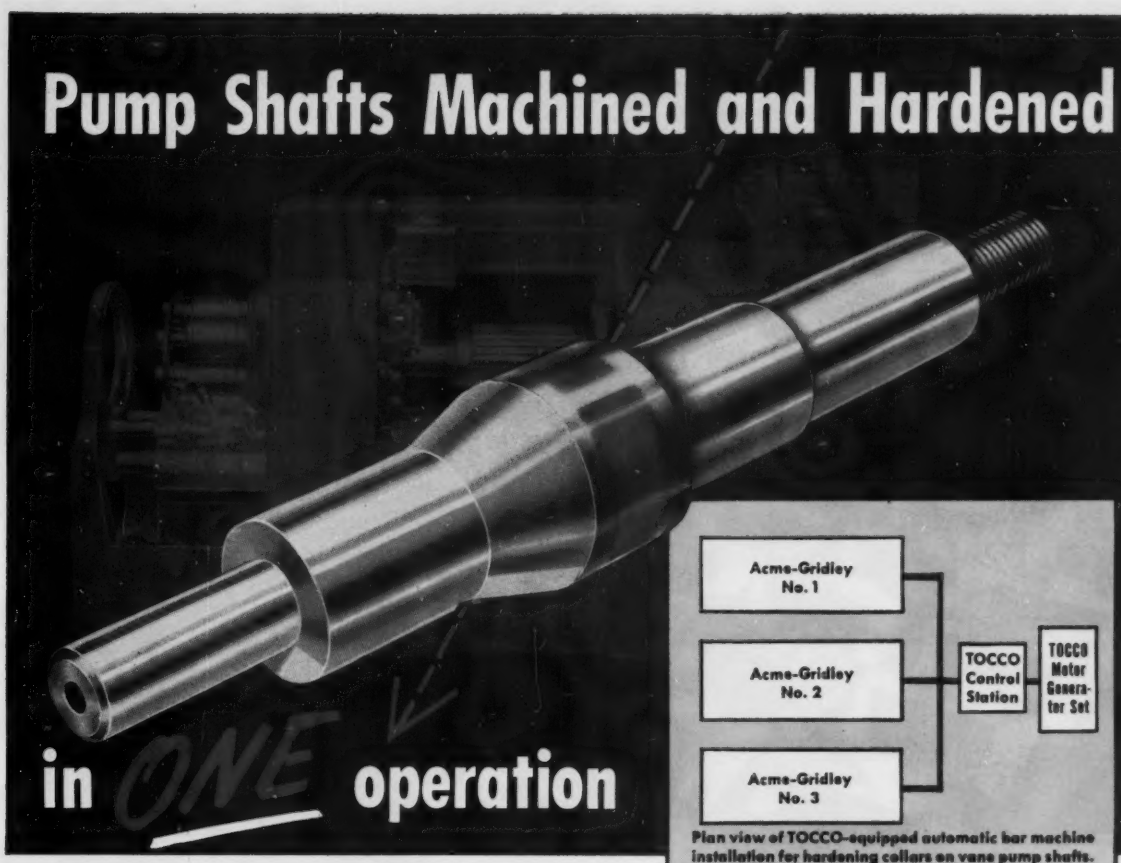
Send for your free copies of "Work Done on the Blanchard", fourth edition, and "The Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY **64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.**

For more information on products advertised, use Inquiry Card, page 245

Pump Shafts Machined and Hardened



Plan view of TOCCO-equipped automatic bar machine installation for hardening collars on vane pump shafts.

with TOCCO* Induction Heating

TOCCO-equipped 8-spindle Acme-Gridley Bar Automatics at a large automotive manufacturer's plant produce vane pump shafts for power steering units in one completely automatic operation!* No handling—no hardening cost except power!

A TOCCO inductor, mounted at one station of each automatic, hardens collars on pump shafts after they have been completely machined at preceding stations on the same machine. Each installation consists of 3 automatic machines equipped with inductor coils powered by a 50 KW, 10,000 cycle TOCCO unit. Production from each installation is 360 shafts per hour.

Shafts are made of C 1144 and only the collar is hardened to prevent scoring the seal. TOCCO's rapid heating confines the hardened area to the surface of the collar leaving the rest of the shaft unaffected.

If your products or their components require heat treating, soldering, brazing or heating for forging, it will pay you to investigate TOCCO for better, faster production at lower unit costs.

*A Patented Process

THE OHIO CRANKSHAFT COMPANY

TOCCO

Mail Coupon Today

NEW FREE BULLETIN

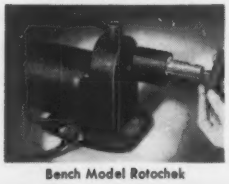
THE OHIO CRANKSHAFT CO.
Dept. M-12, Cleveland 1, Ohio
Please send copy of "Typical Results of TOCCO Induction Hardening and Heat Treating."

Name_____
Position_____
Company_____
Address_____
City_____ Zone____ State_____

World's Fastest Method of Gaging Threads

Taft-Peirce Rotochek Gages Threads 3 Times Faster

Flexible Shaft Model Rotochek

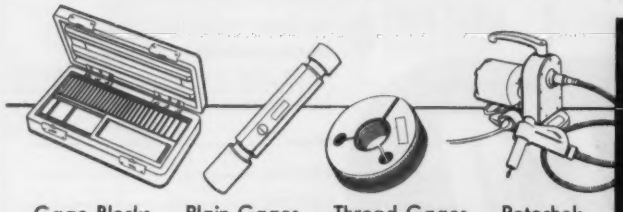


Bench Model Rotochek

You can triple your thread inspection rate with this simple, inexpensive device. A Rotochek is fast . . . accurate . . . easy to use. Operators report from 3 to 4 times as many parts inspected daily.

Simply push-pull and the part is inspected. Bring the part to the Rotochek, or the Rotochek to the part—a slight push and gage screws into the work. Release the pressure and the gage stops. Pull—and it disengages.

Available in bench model, or with gaging head on flexible shaft. Adaptors permit use of reversible thread members and ring gages. Send for bulletin with full description and prices.



Gage Blocks Plain Gages Thread Gages Rotochek

T-P means Top Precision

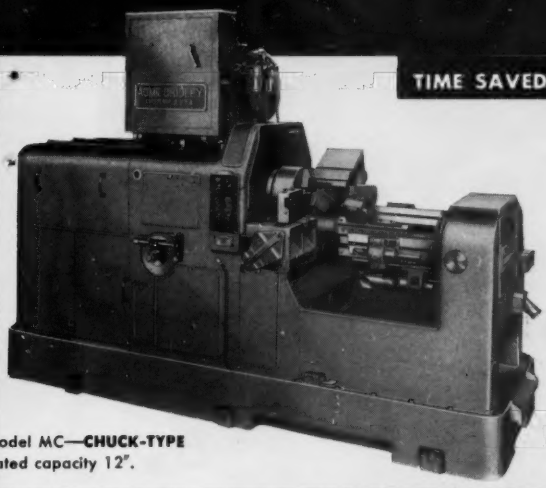
T P

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, R. I.

For more information on products advertised, use Inquiry Card, page 245

CAN YOU TURN NON-PRODUCTIVE TIME INTO SAVINGS LIKE THESE?

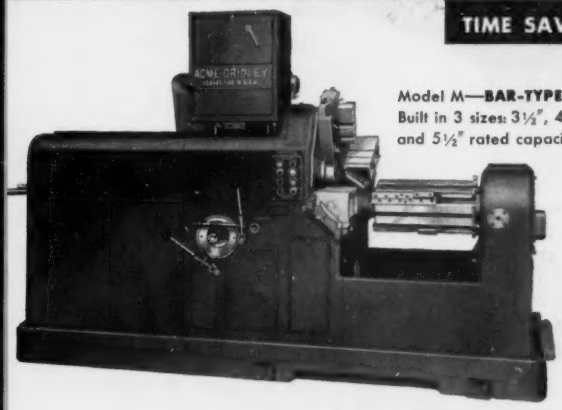
On each of the examples shown here, most of the savings resulted from reducing the time between cuts. Almost all modern machines can make chips as fast as present day cutting tools can "take it," but only Automatically Controlled Cycle* gives you an opportunity to save where it counts most — by reducing non-productive time required to withdraw the tool, index the turret and advance the tool to the work. Acme-Gridley Fully Automatic Turret Lathes do this job at accelerated speeds — with minimum waste of time and manpower



odel MC—**CHUCK-TYPE**
ated capacity 12".

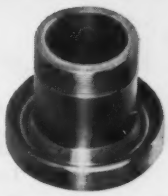
TIME SAVED on Acme-Gridley Fully Automatic Chuck-Type Turret Lathe

Part Name	Finger Holder Body	Master Collet Blank
Material	6⅝" dia. Semi-Steel	6" dia. 4160 Steel (Solid Slug)
Former Time	39.2 minutes	98 minutes
"MC" Time	11.2 minutes	35.4 minutes
	Savings 28 Min.	**Savings 62.6 Min.**



Model M—**BAR-TYPE**
Built in 3 sizes: 3½", 4¼" and 5½" rated capacities

TIME SAVED on Acme-Gridley Fully Automatic Bar-Type Turret Lathe



Part Name	Sleeve—4x3¼" long	Whirl—3½x4⅝" long
Material	1112 Steel	Leaded Open Hearth Steel
Former Time	30 minutes	21 minutes
"M" Time	6 minutes	5.7 minutes
	Savings 24 Min.	**Savings 15.3 Min.**

Here's what AUTOMATICALLY CONTROLLED CYCLE* means to you

- **The complete machining cycle is faster because all non-productive movements are performed automatically — and at *accelerated* speeds.**
- **Cuts are made (with either high-speed or carbide tooling) as fast as present day cutting tools can take it.**
- **Producing rate is thus predetermined and remains the same at the end of the shift as at the start.**
- **Machining is done at the surface speed best suited for required finish and tolerance because each toolslide is independently cammed and selective spindle speeds are automatically controlled.**

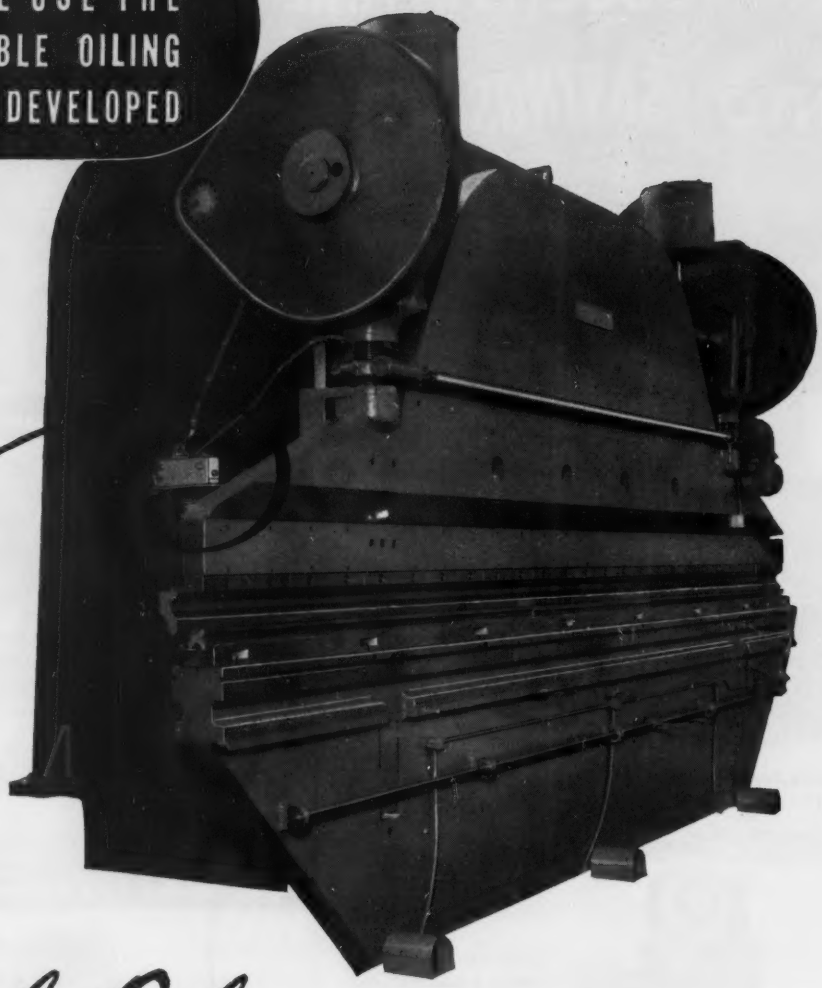
Standard on all Acme-Gridleys

The NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

ACME-GRIDLEY BAR and CHUCKING AUTOMATICS
1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • Limit, Motor Starter and Control Station Switches • Solenoids • Contract Manufacturing.

MACHINES OF GREAT PERFORMANCE USE THE MOST DEPENDABLE OILING SYSTEM EVER DEVELOPED



Illustrated is Madison-Kipp Lubricator Model FD installed as original equipment on a ⅜" by 20' Cincinnati Press Brake, manufactured by the Cincinnati Shaper Co., Cincinnati, Ohio.

MADISON-KIPP *fresh Oil* . . . by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed.

MADISON-KIPP CORPORATION

203 Waubesa Street, Madison 10, Wis., U.S.A.

ANCIENS ATELIERS GASQUY, 31 Rue du Marias, Brussels, Belgium, sole agents for Belgium, Holland, France, and Switzerland.

WM. COULTHARD & CO. Ltd., Carlisle, England, sole agents for England, most European countries, India, Australia, and New Zealand.

- *Skilled in* DIE CASTING *Mechanics*
- *Experienced in* LUBRICATION *Engineering*
- *Originators of Really High Speed* AIR TOOLS

For more information on products advertised, use Inquiry Card, page 245

C.P.C.

can help you streamline production of LARGE STAMPINGS

Clearing triple, double and single action underdrive presses streamline production of large stampings by dividing manufacturing functions to two floor levels. Uninterrupted flow of in-process material takes place at the upper level, while scrap disposal and equipment servicing is accomplished below.

Clearing underdrives designed with the new Clearomatic clutch make it possible to double the operating speed of the press in comparison to conventional methods. *Clearing Productivity Consultants, men who have direct experience with this kind of highly productive installation, are ready to help you plan a streamlined metal-forming operation. Let them discuss with you the new concept of productivity made possible with Clearing equipment. Call or write for complete information, without obligation.

CLEARING PRESSES

THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION • 6499 West 65th Street, Chicago 38, Illinois • HAMILTON DIVISION, Hamilton, Ohio

What's Behind This Cutting Oil Picture?

Behind this cutting oil picture there's a story well worth telling . . . a story of 10 years' operation of the M. O. Devers Screw Machine Products Company.

During this time Devers has acquired and maintained a reputation for turning out the very highest quality precision machined parts and turning them out on time.

And during this same period, the oil that has helped Devers to achieve this enviable record is Cities Service Chillo #10 Cutting Oil. This one unusual oil has been used for work covering 1018, 1020, 4140, and stainless steel, and, says Devers official Harry E. McDaniel, "We have found it superior for all these machining operations."

For longer tool life, closer tolerances, and a simpler cutting operation, you—like the M. O. Devers Company—will find it profitable to investigate Cities Service Chillo Cutting Oils. Contact your nearest Cities Service representative or write Cities Service Oil Company, Sixty Wall Tower, New York 5, N.Y.

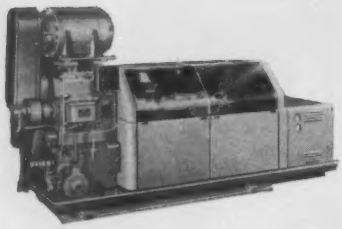
CITIES SERVICE
QUALITY PETROLEUM PRODUCTS

For more information on products advertised, use Inquiry Card, page 245

King - size

Here is one of the year's largest planers, a GRAY, immense in size, yet so superbly engineered and magnificently built that its precision performance is a marvel to behold. All GRAY planers from king-size Giants to eager Cubs are built for high production. They have more original engineering developments and production features than any other planer. They are in such demand that GRAY is the largest planer builder, further proof that *Quality doesn't cost . . . it pays.*

The G. A. GRAY Co., Cincinnati, Ohio



A 3-WAY MARKETING SERVICE FOR USERS OF MACHINE TOOLS

Jones & Lamson now offers a choice of ways whereby you can acquire new machine tools . . . on terms best suited to your own needs. In addition to outright purchase, with its obvious advantages, we offer a "Pay-from-Productivity" plan, on a 1-to-5 year basis, at interest rates as low as 3¼%*. This plan is designed for companies that prefer to finance modern machine tools out of the actual additional earnings these tools produce. Also, a lease plan — in 4 optional forms — for companies that lack the full cash purchase price, or have more pressing uses for their capital.

*(add-on rate)

JONES & LAMSON MACHINE CO.
512 Clinton St., Springfield, Vermont, U.S.A.

UNIVERSAL TURRET LATHES • FAY AUTOMATIC LATHES • AUTOMATIC DOUBLE-END MILLING & CENTERING MACHINES
AUTOMATIC THREAD & FORM GRINDERS • OPTICAL COMPARATORS • AUTOMATIC OPENING THREADING DIES & CHASERS

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UNION

ANNOUNCES

COUNTERBORES

WITH INTERCHANGEABLE PILOTS

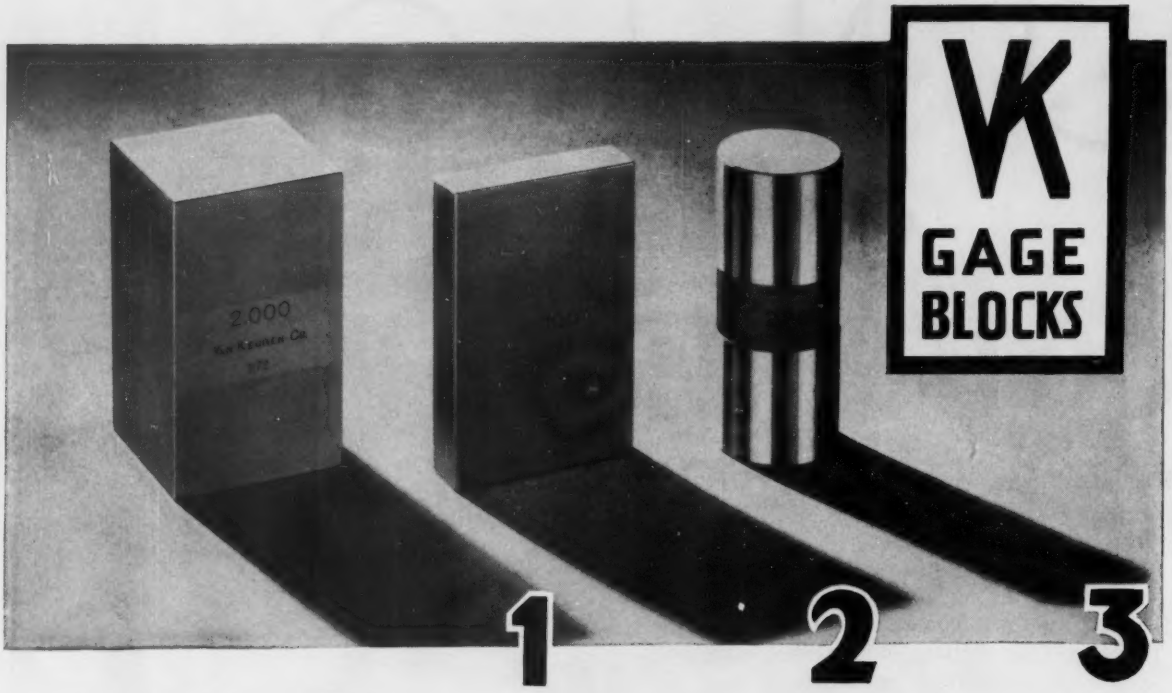
Out of significant knowledge gained in making a wide variety of high precision cutting tools comes Union's High Speed Steel Counterbore with Interchangeable Pilots. Available in standard and aircraft designs. Call or write your Union Distributor for full information.

UNION TWIST DRILL COMPANY • ATHOL, MASSACHUSETTS

End Mills **Milling Cutters** **Gear Cutters** **Twist Drills** **Hobs** **Reamers** **Carbide Tools**

OWNERS AND OPERATORS OF: **S. W. CARD MANUFACTURING CO. DIVISION, Mansfield, Mass.**
BUTTERFIELD DIVISION, Derby Line, Vermont and Rock Island, Quebec

YOUR DISTRIBUTOR IS READY TO SERVE YOU PROMPTLY FROM FULL STOCKS



THREE WAYS to protect production accuracy

To meet closest limits of accuracy and protect production, Van Keuren is currently furnishing three types of gage blocks:

1—SOLID SQUARE MASTER BLOCKS
2—RECTANGULAR REFERENCE GAGES
3—MICROGAGES

Shipment on complete sets of any of these three types can be made within 60 days from receipt of order.

VK Solid Square Master Blocks are accurate to .000004" per inch of length and are designed for laboratory use or to standardize all shop dimensions. Large wearing surface; perfect parallelism. Available in 85- and 41-block sets and guaranteed unconditionally for 5 years not to exceed .0001" in wear.

VK Rectangular Reference Gages are guaranteed accurate to .000008" per inch of length and are designed for the inspection department or precision set up work. They are available in 81-block and 33-block sets. Individual blocks from either of these sets can also be furnished. Certificate of size is also furnished with each set.

VK Microgages are made to an accuracy of .000008 and are designed as working gages for shop use . . . to put accuracy at the machine. Wearing surface of these ⅞" diameter gages is 40% greater than that of rectangular gage blocks hence their long-wearing quality. Available in several set combinations.

Van Keuren Gage Blocks are fully described in Catalog and Handbook No. 35, yours for the asking by writing: The Van Keuren Co., 178 Waltham St., Watertown, Mass.

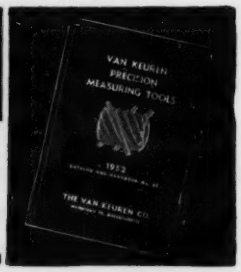
VK

35th YEAR

THE Van Keuren CO.,

178 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires Chrome Carbide Taper Insert Plug Gages



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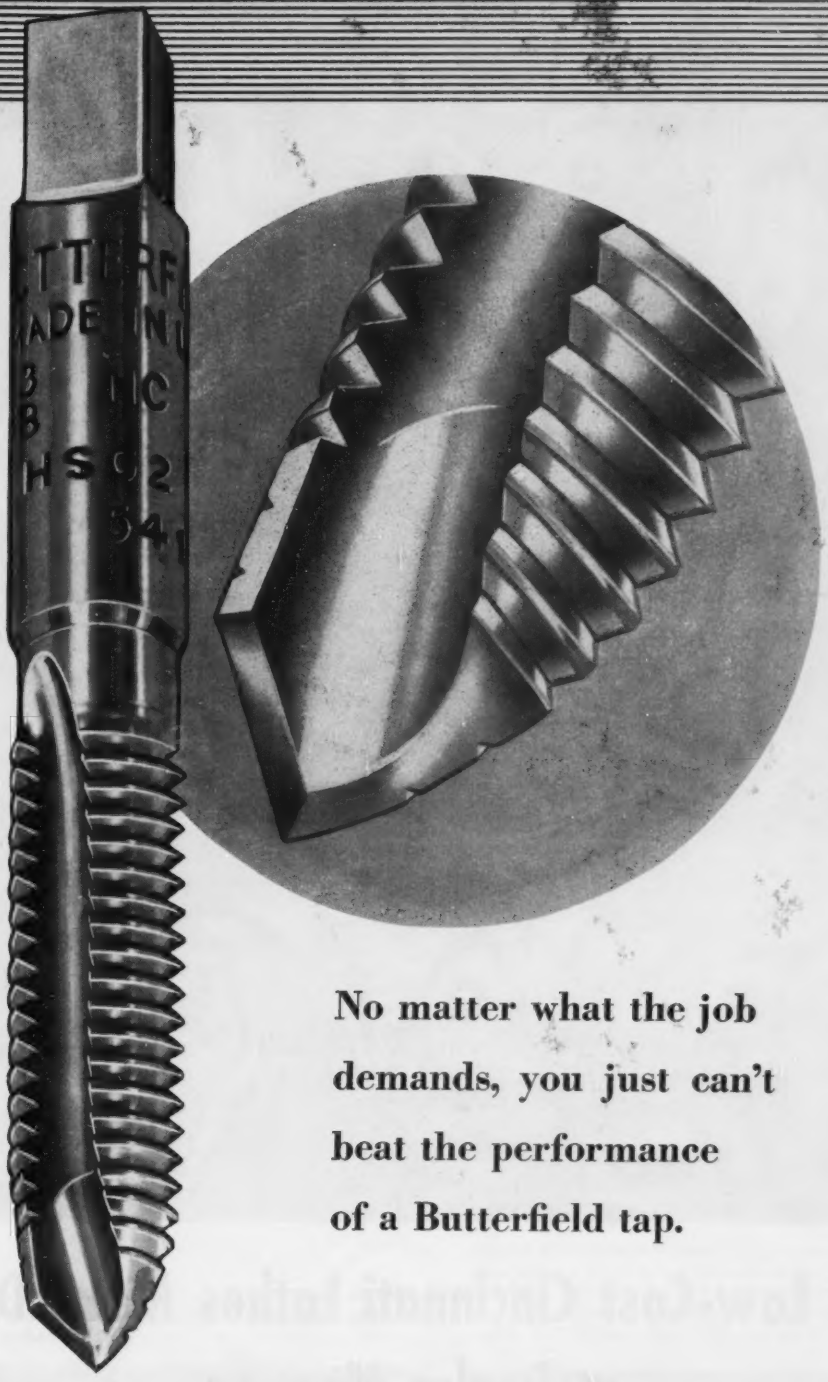


No matter what the job demands, you just can't beat the performance of a Butterfield tap.

BUTTERFIELD

UNION TWIST DRILL COMPANY
BUTTERFIELD DIVISION
DERBY LINE, VERMONT, U.S.A.
TAPS • DIES • DRILLS • REAMERS • COUNTERBORES • SCREW PLATES

FOR BETTER SERVICE
CALL YOUR
BUTTERFIELD
DISTRIBUTOR

New Low-Cost Cincinnati Lathes Make Debut at Dealer Meeting

Cincinnati's latest lathes—the 21½" and 26" Tray-Tops—made their introductory bow October 18 before the expert eyes of 54 dealers. As a team of designers and engineers presented these brand-new babies, here's what these dealers saw and liked:

Lathes with 12 all-geared spindle speeds from 24 to 960 rpm in the high range—with 54 thread and feed changes—flame-hardened ways to retain built-in accuracies—Cincinnati's exclusive Color Match Speed Selector—a totally enclosed quick-change box and hardened gears in all three transmissions.

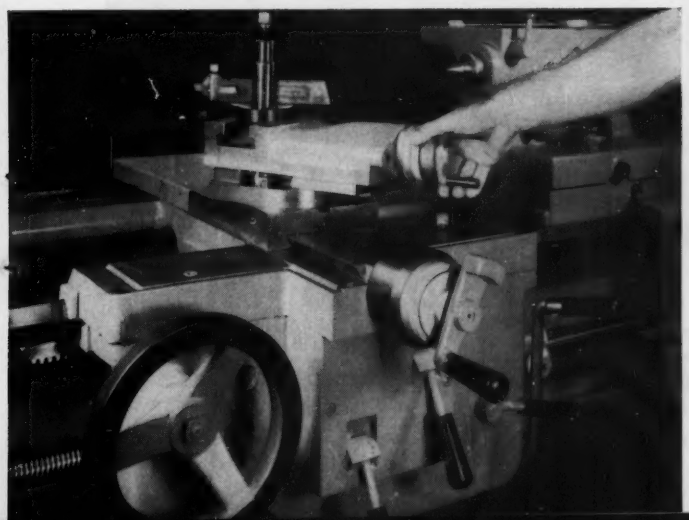
Best of all, they saw lathes priced well within the reach of every shop.

These low-cost Cincinnati Tray-Tops are so new that not all dealers have been supplied with display models. But that needn't keep you from getting the details now. Just write for Catalog T-117 and we'll rush complete descriptive literature. No obligation, of course. Cincinnati Lathe & Tool Co., 3271 Disney St., Cincinnati 9, Ohio, U. S. A.

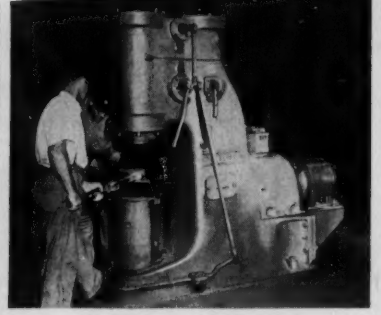
TOTALLY ENCLOSED QUICK-CHANGE BOX guards gears against dirt, chips and foreign matter. It also provides a built-in oil reservoir for automatic lubrication. 54 thread and feed changes—range of 1½ to 92 threads per inch; range of feeds .0019 to .1215.

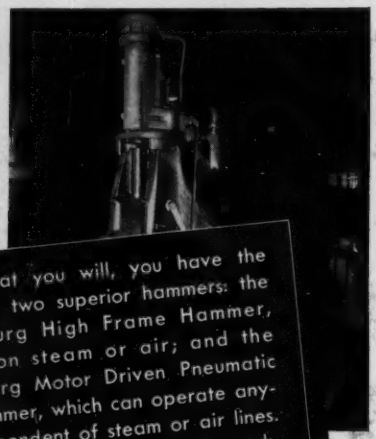
APRON is a one-piece, double-walled casting providing adequate support for all shafts. It incorporates a built-in safety clutch, oil shot pump lubrication and positive jaw feed clutches.

COLOR MATCH SPEED SELECTOR is simplicity, itself. No more reference to index plates and lever positions; just match up the color lines. Spindle speeds range from 16 to 640 rpm (standard) or 24 to 960 rpm (high). Pressurized lubrication to bearings and gears. Three-bearing spindle. 2⅜" diameter spindle hole available.



For Flat Die Forging, Blacksmithing, or Tool Dressing





CALL it what you will, you have the choice of two superior hammers: the Chambersburg High Frame Hammer, operating on steam or air; and the Chambersburg Motor Driven Pneumatic Forging Hammer, which can operate anywhere, independent of steam or air lines. The High Frame Hammer has ample working space, adaptable to the forging of large discs and rings, the upsetting of high stems, etc., and has many other outstanding features. The Pneumatic Forging Hammer is completely self-contained, with its motor driven compressor built-in. It is capable of greater forging output than any other hammer of its type.

Either or both hammers, whether it be a 150 lb., a 600 lb. or a giant 6000 lb., will represent a profitable investment for your flat die, blacksmithing or tool dressing needs. Write today for Bulletins 1-L-9 and 16-L-9.

CHAMBERSBURG ENGINEERING COMPANY • CHAMBERSBURG, PENNA.

CHAMBERSBURG
THE HAMMER BUILDERS

Builders of THE IMPACTER
"FORGING IN MID-AIR"

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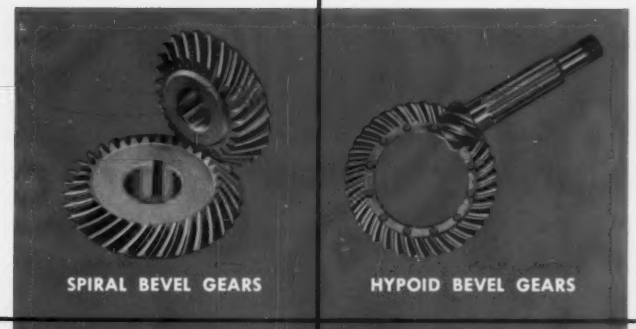
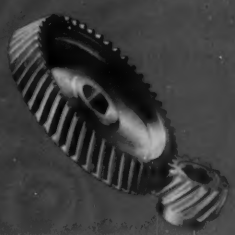


SPIRAL BEVEL GEARS

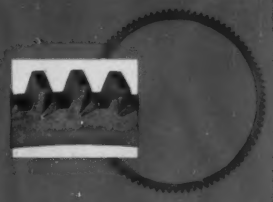
HYPOID BEVEL GEARS

ZEROL BEVEL GEARS

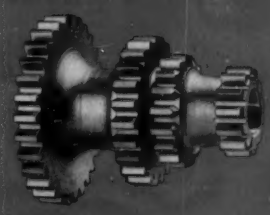
STRAIGHT BEVEL GEARS



ANGULAR BEVEL GEARS



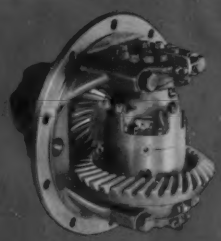
FLYWHEEL RING GEARS



SPUR GEARS

HELICAL GEARS

SPLINE SHAFTS



GEAR ASSEMBLIES

Through 40 years of gear making, these are the 10 gear types that have emerged as our specialties.

If one (or more) of these types is included in your product, it may pay you to review the facts about Double Diamond Gears contained in this book.

We will be happy to send you a copy. Why not write for one today?

DOUBLE DIAMOND TRADE MARK GEARS

FOR AUTOMOTIVE, FARM EQUIPMENT & GENERAL INDUSTRIAL APPLICATIONS
GEAR-MAKERS TO LEADING MANUFACTURERS

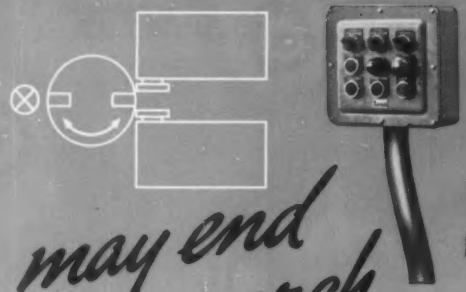
Automotive Gear Works, inc.

ESTABLISHED IN 1914 RICHMOND, INDIANA

Duplex Milling

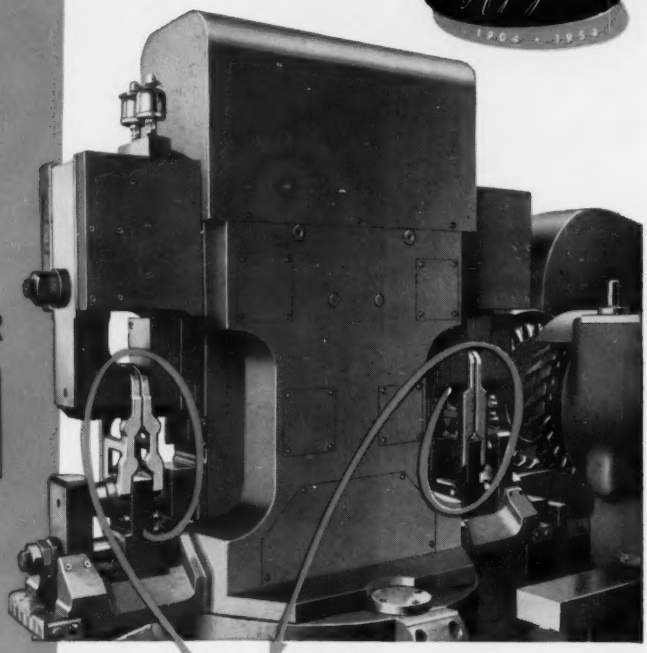
as Engineered by

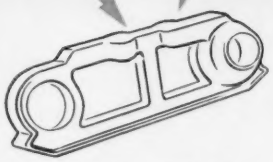
MOTCH & MERRYWEATHER



may end your search

Fifty Years 1904 - 1954

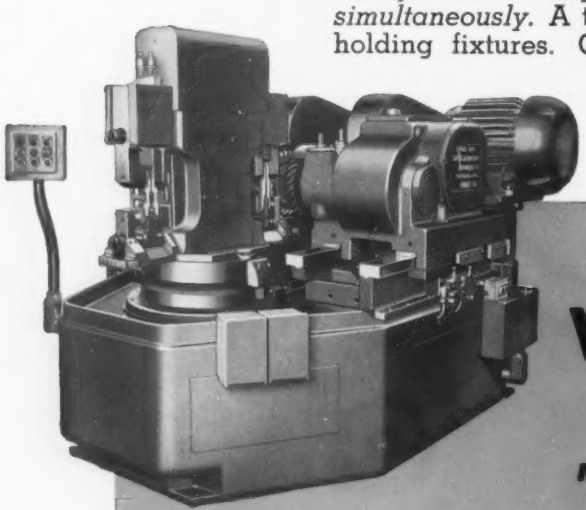




Both sides of tractor side bars are face milled. Production is 240 pieces per hour using high speed steel cutters.

PRODUCTION CAN BE RAISED 50% by Motch & Merryweather's *Duplex Milling Method!*

• Production milling is given new meaning by Motch & Merryweather's duplex method. Two heads mill two parts *simultaneously.* A table indexing 180° has two sets of work-holding fixtures. One operator unloads and loads during *duplex milling* at the opposite fixture. Fully automatic operation sets new production limits. Consult Motch & Merryweather about your production milling.



THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION
CLEVELAND 13, OHIO

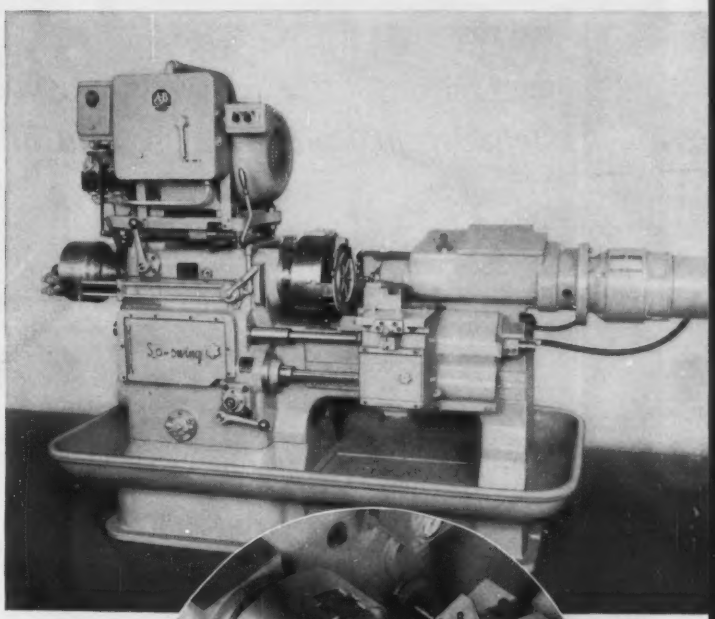
Builders of Circular Sawing Equipment, Production Milling, Turning and Special Machines

For more information on products advertised, use Inquiry Card, page 245

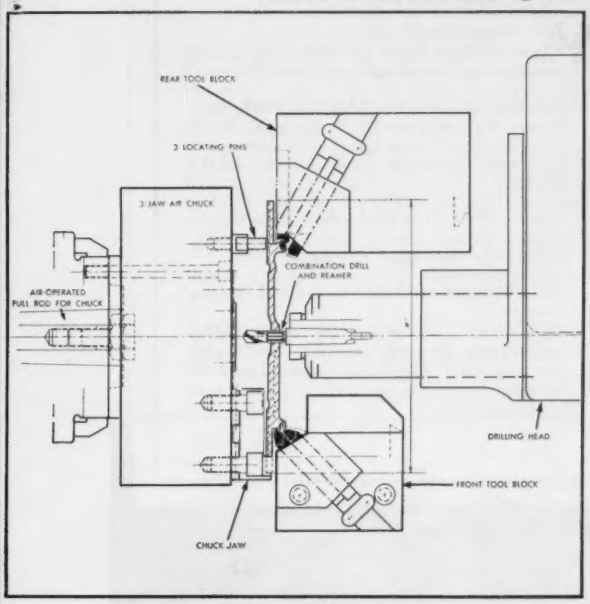
MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK

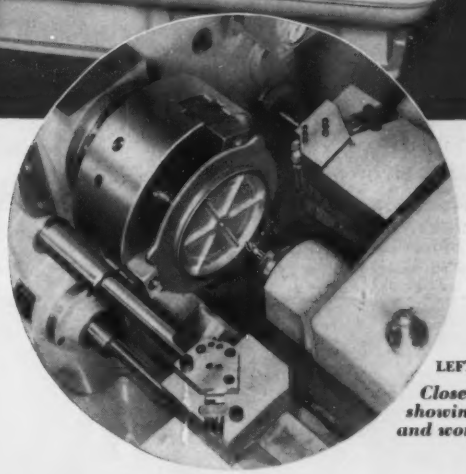
MODEL "LR" Lo-swing DRILLS AND REAMS SIMULTANEOUSLY WITH TURNING AND FACING OPERATION



RIGHT
Model "LR" Lo-swing Automatic Lathe equipped with Special Motorized Drilling Head



LEFT
Tooling layout for machining and drilling Direct Drive Clutch



LEFT
Close-up view showing tooling and work

Problem: **To turn, face and groove the large diameter of a direct drive clutch, and to drill and ream center hole in a single operation.**

Solution: **The Model "LR" Lo-swing Automatic Lathe selected for this job was equipped with a special Drilling and Reaming Attachment which replaced the standard tailstock. This attachment is an electrically-driven, self-contained unit with its own feed cam which permits fine feed for drilling and coarse feed for reaming. Two tools on the front carriage turn two diameters. Two facing and one grooving tool are mounted on the back attachment. While all tools, including the drill, operate simultaneously, the motorized drilling head provides the correct speed for drill and reamer, while the main headstock drive provides correct speeds for machining the large diameters.**

The work, which is cast iron, is held in a 3-jaw, air-operated chuck. Machining tools are cemented carbide while the combination drill and reamer is of high-speed steel.

Seneca Falls engineers are at your disposal. Let us help solve your turning problems.

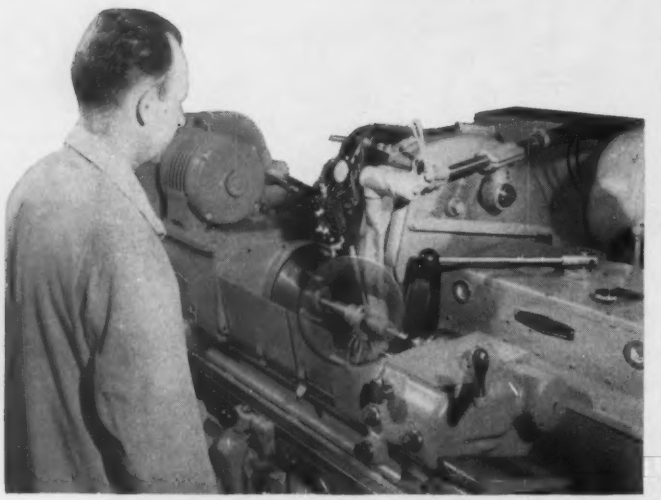
SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

PRODUCTION COSTS ARE LOWER WITH Lo-swing

More proof of how

Norton G Bond wheels boost O.D. grinding profits

Users praise "TOUCH of GOLD" *performance that steps up production rate and quality while cutting costs*



Cylindrical Grinding is faster, easier, more profitable when wheels made with the Norton G Bond — most efficient vitrified bond ever developed — add the "Touch of Gold."

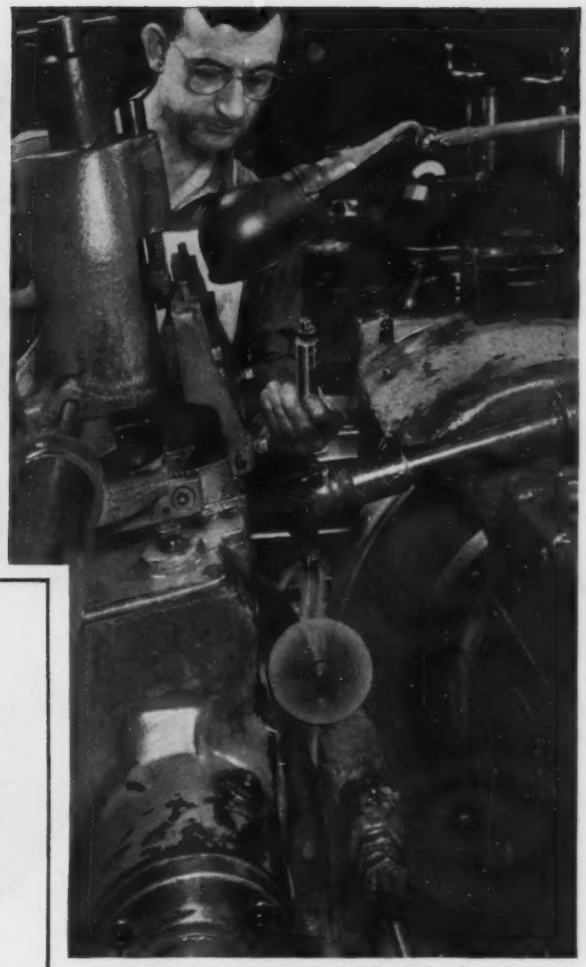
Users' Reports on Cylindrical Grinding

Job: Assorted small diameter stock.
Report: G Bond wheel gave 50% more pieces per dressing, with greatly improved finish.

Job: Rear axle pinions, SAE 4120 stock.
Report: Grinding to .001″ limits, G Bond wheels removed stock faster, more uniformly. Gave more pieces per dress, with less spark-out time.

Job: 3″ diameter formed roll, hard steel.
Report: Cooler cutting, crush-trues nicely, holds form. Best wheel ever used.

Job: Hardened steel raceways of ball bearing "inners."
Report: Ground 60 of the .075″ radius grooves per dressing, compared to 25 with previous wheel. This G Bond wheel, also used on critical shoulder job, held form and gave superior finish.



Centerless Grinding benefits by the G Bond's unique ability to hold each abrasive grain just long enough for maximum cutting action — an important "Touch of Gold" advantage.

Users' Reports on Centerless Grinding

Job: ¾" diameter x 2" textile spindles, spindle steel.
Report: G Bond wheels produced better form and finish than any other wheels. Gave 50% more pieces per dressing on both rough and finish grinds. Also eliminated previous distortion of spindles due to overheating.

Job: Removing up to .010" per pass on varied steel parts.
Report: Dressing required only once every 4 hours, instead of every 40 minutes. Best general purpose wheel ever used on our centerless machines.

Job: Thru-feed ½" diameter bar stock, stainless steel.
Report: Cut faster and freer, held size better and gave better finish than previous standard wheel.

Job: ½" diameter shafting, drill rod and stainless steel.
Report: G Bond wheel gave 16 hours longer wheel life and produced much better finish.

In O.D. grinding, as in many other precision and semi-precision grinding operations, first-time users of G Bond wheels are quick to recognize that here, at last, are wheels that will outperform any others they ever used. Advantages like these are the reasons why:

Cooler cutting action . . . faster stock removal . . . better finish . . . more pieces per dressing . . . longer wheel life . . . easier dressing, with less wear on diamond or on crushing roll.

Added up, all these new advantages mean valuable production economies and improvements in your product. That's why G Bond users have been glad to show their appreciation — with a steady stream of endorsements like those reproduced here.

Your Norton Distributor

is ready with proof of how G Bond wheels can add the work-speeding, profit-increasing "Touch of Gold" to your own cylindrical or centerless grinding jobs. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your classified 'phone directory. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass. W-1575

Making better products . . . to make other products better

NORTON

and its BEHR-MANNING division

NORTON: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

"We saved them time...increased tool life with one cutting oil!"

A large southern machine tool company and contract shop recently installed a 2½-inch, 5-spindle automatic screw machine on which different metals are machined every day.

Mr. Horace Lane, a Sinclair Industrial Lubrication Engineer, was called in to recommend a cutting oil that would perform equally well on brass, aluminum and steel. Mr. Lane reports, "It would have been impractical to drain 150 gallons of oil for each different contract job, so this machine needed a multi-purpose cutting oil – one containing both sulfur and lard for their wetting and anti-weld properties.

"From my past experience," Mr. Lane continues, "I recommended Sinclair SUPER WILKUT® which contains a balanced proportion of sulfur and fatty oil, in non-corrosive form, plus good heat-transfer characteristics. *Results were highly satisfactory!* Sinclair SUPER WILKUT saved time and money by eliminating frequent oil drains. It also helped to maintain close tolerances and prolonged tool life."

Why not let a Sinclair Lubrication Engineer help solve *your* lubrication problem. *There's no obligation.* Contact your local Sinclair office or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR CUTTING OILS

For more information on products advertised, use Inquiry Card, page 245

NEW

JONES & LAMSON

MODEL FC-30 OPTICAL COMPARATOR

with Electronic, Variable Speed Vertical Measuring Control

Easy, close access to 30″, eye level screen
New brilliant surface illuminator

Thirty-five years' experience in developing optical comparators—16 years' experience with 30″ viewing screens—has gone into making this ultra-modern precision inspection machine.

Built to highest machine tool standards, its wholly integrated design allows the operator to view the entire screen at close range while making quick, accurate measurements.

Electronic, variable speed vertical measuring control allows the work piece to be raised or lowered, slowly or rapidly to the exact measuring point desired. Imagine — quick, precise measurements to .0001″, in one motion, with fingertip pressure.

The FC-30 also has these additional *exclusive features*: 5″ and 8″ diameter capacity with easy change-over; 6″ projection lens optional; carbide tipped micrometers graduated for direct reading in either direction, combined with micrometer zeroing anvil; measuring dial illuminators.

Available for immediate delivery.

P.S. *Write today for folder containing complete information.*

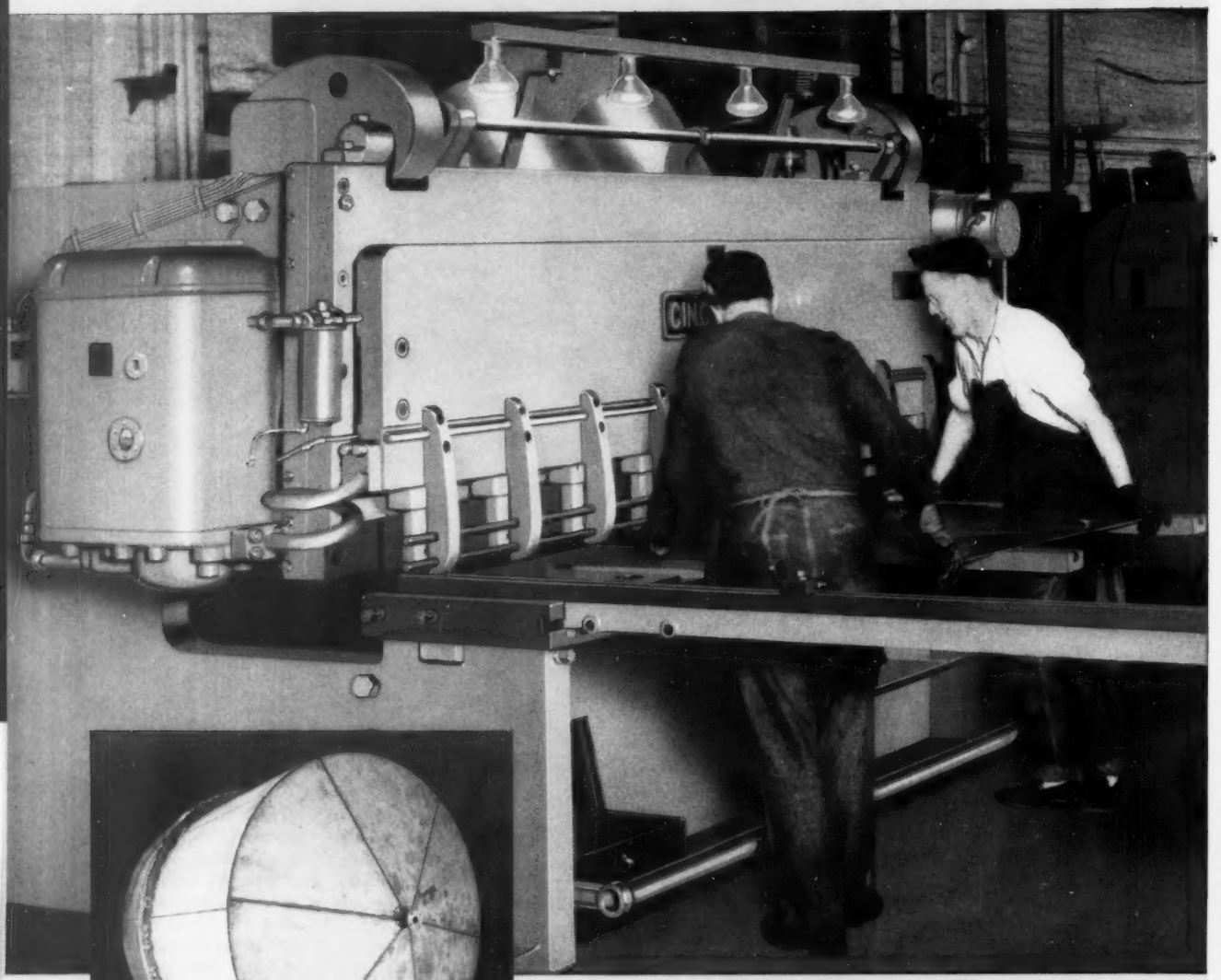
JONES & LAMSON

World's largest manufacturer of Optical Comparators since 1919

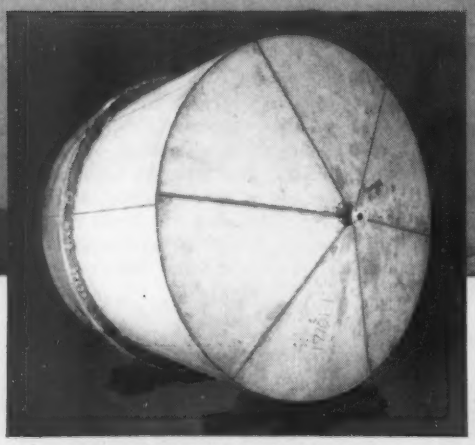
JONES & LAMSON MACHINE CO., 512 Clinton St., Dept. 710, Springfield, Vt., U.S.A. **OPTICAL COMPARATOR DIV.**

They handle the job faster with

CINCINNATI

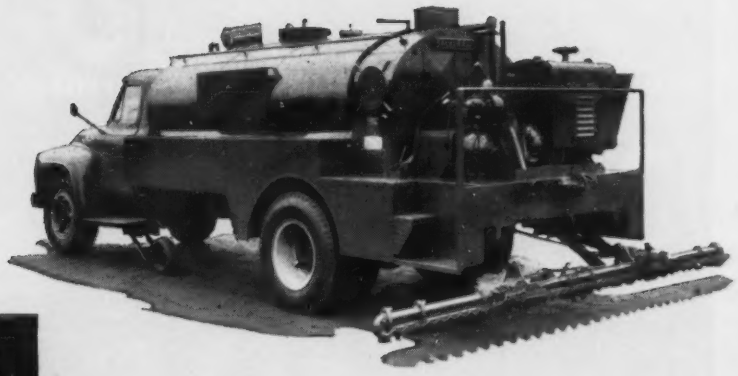


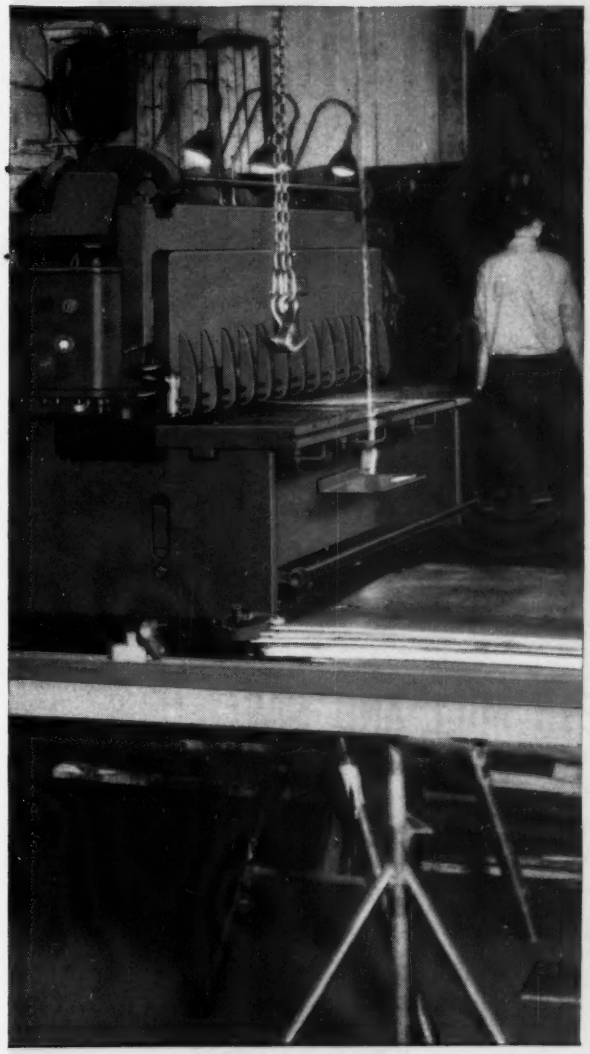
Photos courtesy the Littleford Bros., Inc., Cincinnati, Ohio.



Shearing stainless steel for tanks in the Littleford Shops.

Shears...





at LITTLEFORDS...

"Faster handling—with a high degree of accuracy", say Littleford Bros.

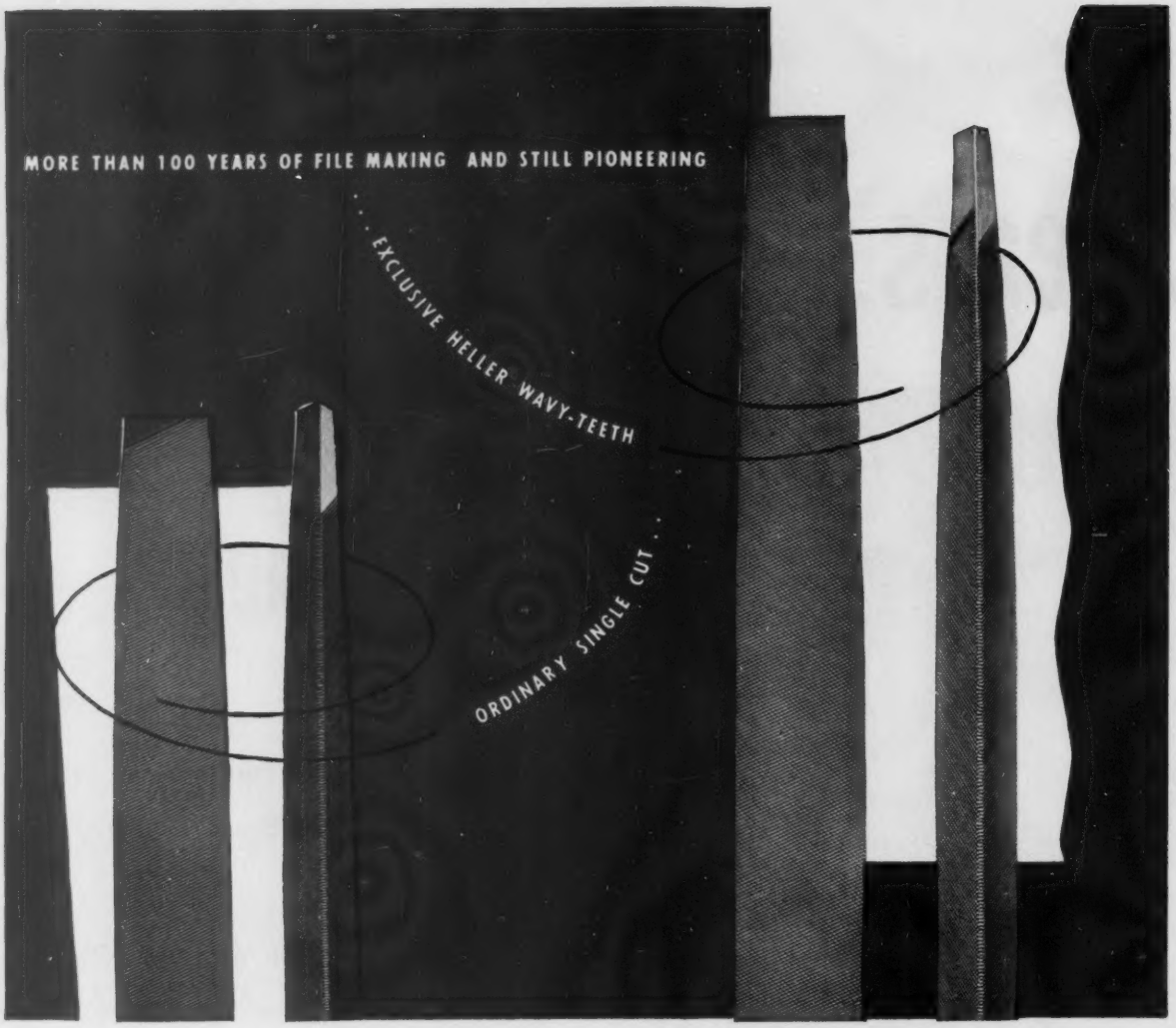
Simple, rapid and positive gauging, with the accurate shearing performance of these Cincinnati Shears—gives a clean cut economical production, with long knife life and low maintenance."

Write for Shear Catalog S-6.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI



HELLER WAS *FIRST* WITH WAVY-TEETH MILL AND SAW FILES

You can remove more metal faster when you use Wavy-Teeth mill or saw files instead of ordinary single cut mill or saw files. Always specify "Wavy-Teeth" to get this exclusive Heller tooth arrangement . . . a typical development of Heller research. Through a continuous program of inspecting, testing and improving, Heller guarantees file users "the best."

other Heller *Firsts*

SPIRAL-CUT Half Round Files
NUCUT Wavy-Teeth Files
VIXEN Milled Curved Tooth Files

*Registered T.M.

VIXEN
American-Swiss
NUCUT

THESE 3 FAMOUS BRANDS ARE MADE ONLY BY

HELLER BROTHERS SINCE 1836 TRADE MARK

HELLER BROTHERS CO. *America's Oldest File Manufacturer* **NEWCOMERSTOWN, OHIO**

YOUR *HELLER* DISTRIBUTOR CAN SUPPLY ALL YOUR FILE NEEDS

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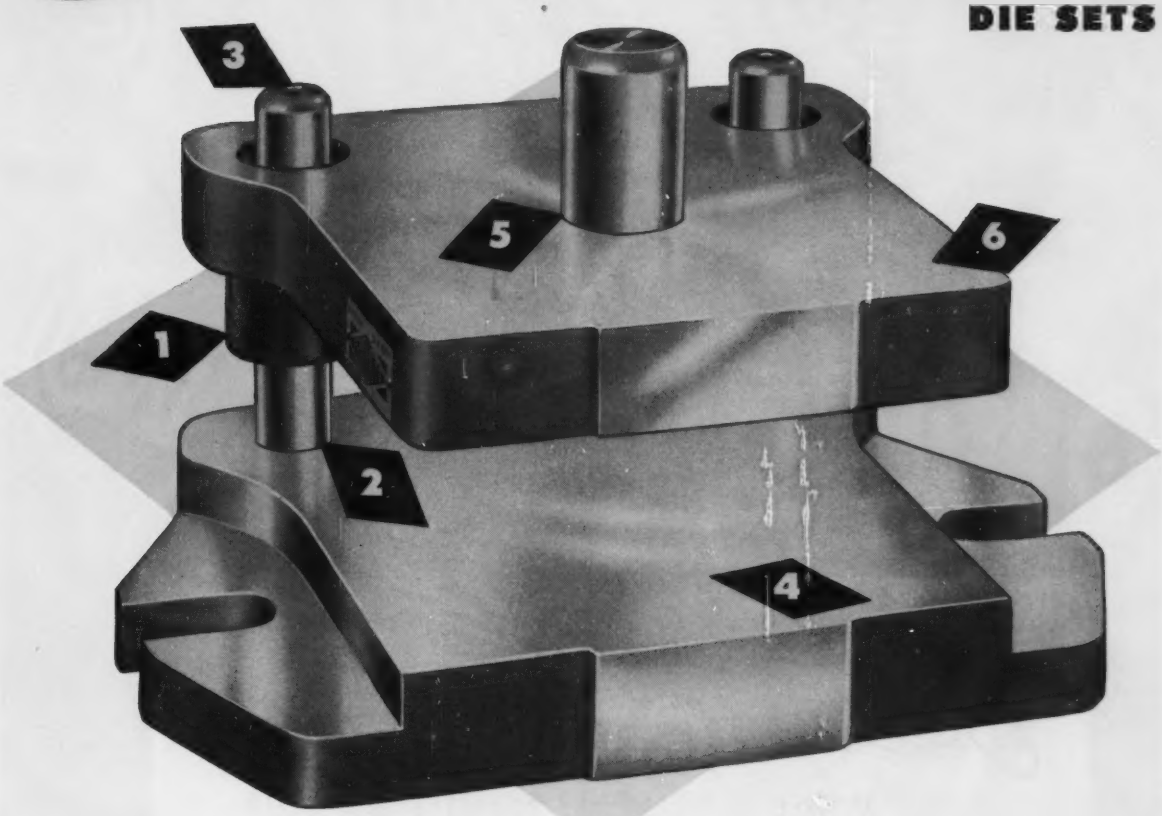
6 reasons for buying.. PRODUCTO DIE SETS



1. Bushings have an absolutely **uniform inside diameter,** resulting in **full-bearing** and **extra long life.**

2. New design die set gives added **strength** and assures **accurate location** of pin and bushing holes.

3. Accuracy of guide pins and bushings are **checked** on **light guages** reading to 50 millionths of an inch.

4. Parallelism and **flatness** held to **close limits** by rough machining prior to grinding.

5. Shank, cast as integral part of semi-steel die set, can be **inserted** or **welded** on all-steel sets.

6. Surface plates, accurate to within .0001", check **flatness** of ground surfaces and **parallelism** of die set.

To make an accurate die, an accurate die set must be used. For this reason, every Producto die set is an instrument of precision.

If planning a new die today, order your die set by the new Producto catalog — selection is easy, delivery is prompt.

THE PRODUCTO MACHINE COMPANY
985 Housatonic Ave., Bridgeport 1, Connecticut

For Precision Die Sets *Fast* Call....

PRODUCTO

5PD52A

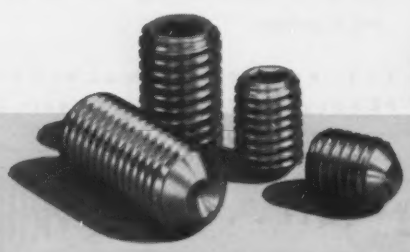
ALSO MAKERS OF DIE ACCESSORIES, FEEDING EQUIPMENT, VISES, MACHINERY.

NEW
Allenpoint Set Screws

WITH SCIENTIFICALLY-DESIGNED SMALLER CUP POINTS

Smooth, deep point penetration for greater holding power and resistance to vibration; precision formed threads and accurate thread lead for maximum locking action. Comparative tests by leading laboratory prove Allen Set Screws unmatched in performance. Write to Advertising Department for Bulletin C-33A.

When ordering through your local industrial distributor, Specify Genuine Allenpoint Set Screws.



ALLEN
MANUFACTURING COMPANY
Hartford 2, Connecticut U.S.A.

ALLEN HEAD

For more information on products advertised, use Inquiry Card, page 245

UNPARALLELED GRIP *from parallel jaws*

Latest And Greatest In Collet Design! Tool engineers and machine tool builders praise the Jacobs Rubber-Flex Collet as one of the outstanding developments in modern tool history. This new principle of collet construction brings you not only great improvements in gripping power, accuracy, and service life, but — *for the first time* — a collet with a full ⅛ inch capacity range.

The Jacobs Manufacturing Company, West Hartford 10, Conn.

IF IT'S A JACOBS IT HOLDS

Jacobs and your local distributor

are ready to deliver the chucks you need and the service you deserve.

. . . first in chucks

. . . first in service

the Welder is to the TUBE MILL.....

Both footage and tonnage-wise, electric-weld tube production depends, above all else, on the welder.

Much of the credit for the high production and rapidly growing demand for electric-weld pipe and tubing goes to notable advances in tube welders introduced by Yoder.

First came the Yoder welder incorporating their revolutionary rotating transformer. Then the present Four-in-One welding transformer —most compact, trouble-free and efficient resistance welder yet known.

More recently, Yoder has perfected mills for *induction welding of steel pipe* and tubing, at speeds up to 250 f.p.m., using hot rolled, unpickled strip, at a substantial cost saving.

For *aluminum, brass, nickel, monel* and other non-ferrous metals, Yoder also has pioneered the development of a new high-speed electric induction tube welder.

These developments—all Yoder Firsts—afford profitable new opportunities for pipe and tube manufacture. Incidentally, they also account for the overwhelming preference for Yoder tube mills among electric-weld pipe and tube producers.

Literature, consultations and estimates without cost or obligation.

THE YODER COMPANY • 5504 Walworth Avenue, Cleveland 2, Ohio

Complete Production Lines

- ★ COLD-ROLL-FORMING and auxiliary machinery
- ★ GANG SLITTING LINES for Coils and Sheets
- ★ PIPE and TUBE MILLS—cold forming and welding

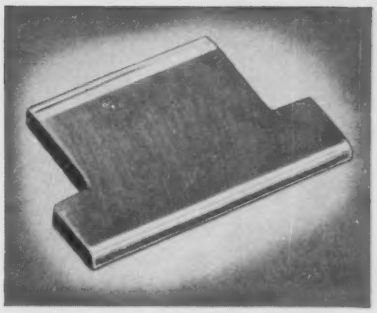
ENGINEERING YODER MANUFACTURING

For more information on products advertised, use Inquiry Card, page 245

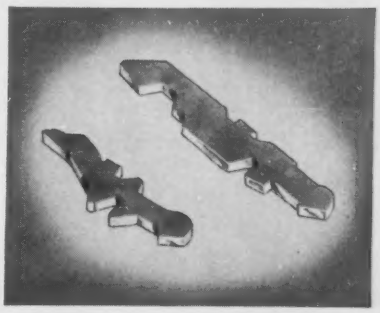
Why wait?
CUT YOUR COSTS NOW!

let the leading manufacturer of broaching equipment show you how to lower your break-even costs.

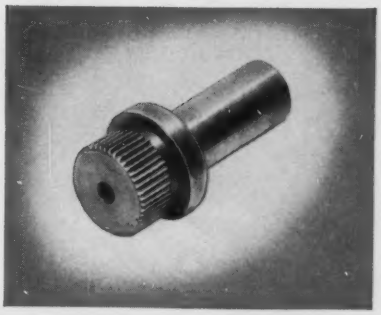
TEN TIMES FASTER than previous methods —broaching top and bottom radii on these automatic transmission reverse band anchors is helping one manufacturer lower the break-even costs. The design called for both edges to be rounded with a taper leading into one of the rounded edges. Besides increasing production by 10 times, the broached surfaces are more accurate, and costs are kept to a minimum. Thousands of these band anchors are being machined between broach sharpenings.



THIRTY TIMES FASTER than milling—broaching lowers costs in the production of the intricate shapes of these copper breaker points. Seven pieces at a time are broached at a rate 30 times faster than by milling. 75,000 pieces are completed before it is necessary to sharpen the broach. 800 to 1000 pieces per hour are broached on one Colonial machine with only two sets of Colonial broaches.

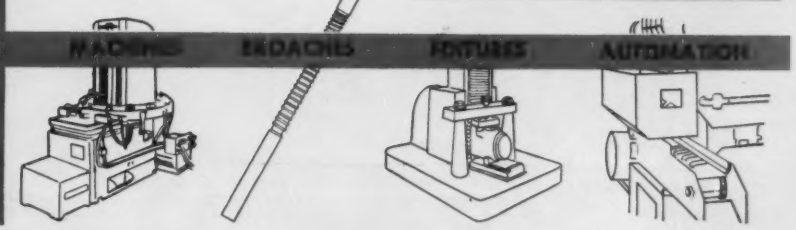


TWENTY TIMES FASTER than other methods —the serrations on the end of this shaft are cut with a button broach in a single pass. Cost per part is reduced substantially because broaching is 20 times faster. This, and hundreds of other applications on file at Colonial, are ample testimony of the tremendous cost-cutting potential that can be yours by utilizing "Unified Broaching" by Colonial. Send us prints of your parts—let us show you how to cut costs over your present machining methods.



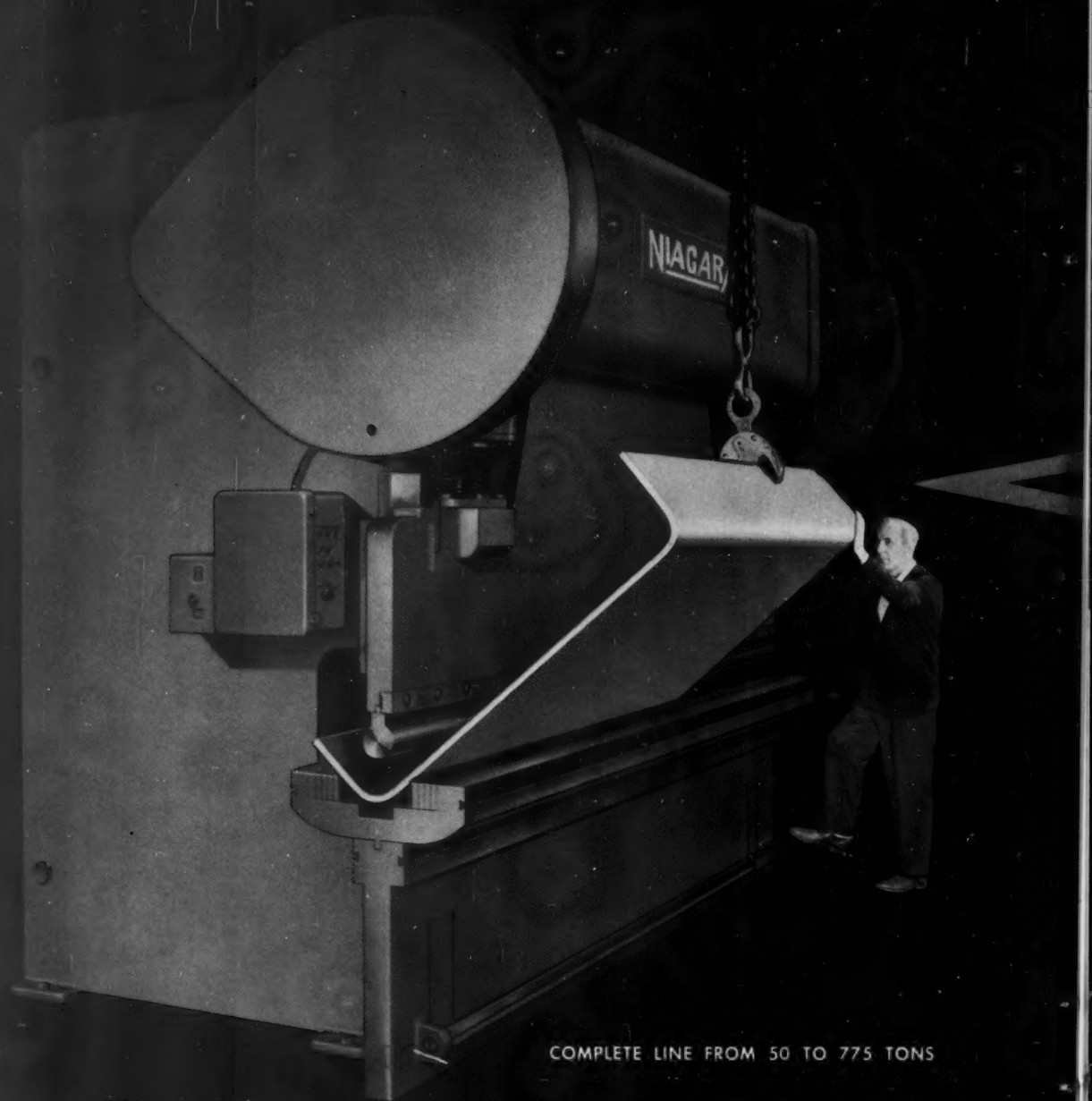
Unified Broaching

COLONIAL



IT'S THE NEW, "YEARS-AHEAD" LINE ...

Far out front on every point of comparison



COMPLETE LINE FROM 50 TO 775 TONS

NIAGARA
MACHINE & TOOL WORKS
1879 75 1954

America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work

... NIAGARA

ALL STEEL PRESS BRAKES

"MULTI-MACHINE" VERSATILITY TO BOOST PRODUCTION

Practically limitless in their scope of forming, bending, punching, blanking and related operations, Niagara Press Brakes get more done for you because they do more jobs. One reason: Advanced design. Another: The extensive line of Niagara Press Brake Dies available.

UNIFORM BENDS WITH STRAIGHT-EDGE ACCURACY

Double end twin drives with double reduction gearing, *on all models*, provide uniform, constant application of power at both ends of the ram. Off-center loading presents no problem.

Rugged, streamlined frames feature box type crowns of unequaled strength and rigidity, assuring maximum resistance to deflection and permanent alignment of bearings and ram.

3-SHIFT STAMINA TO HANDLE WORK-HEAVY SCHEDULES

Close attention has been given to every design detail. Nothing has been overlooked. Each frame size has been scientifically tested to detect and eliminate harmful stresses at all critical points.

Laminated non-metallic ways, an exclusive Niagara feature, reduce wear to an absolute minimum, providing accurate alignment and longest possible service life. All gearing is totally enclosed in sealed oil baths for thorough, clean lubrication.

Once again, Niagara's forward-thinking engineering has produced a metal working machine years ahead of its time. As you become familiar with the significant developments embodied in this revolutionary new line of all steel press brakes, you will realize why it carries the Niagara nameplate. After all, who is more uniquely qualified to be its builder than the builder of America's most famed and most complete line of presses, shears, other machines and tools for plate and sheet metal work?

Call in your nearest Niagara representative at once. Let him tell you, *in detail*, what these great, new press brakes can do for you.

CHECK ALL THE FACTS, YOURSELF!

Compare. Make a careful, feature-by-feature appraisal of Niagara's years-ahead press brake design. Write for new Bulletin 89C . . . the most comprehensive press brake literature ever published.

NIAGARA MACHINE & TOOL WORKS
BUFFALO 11, N. Y.
DISTRICT OFFICES:
Detroit • Cleveland • New York • Philadelphia
Dealers in principal U. S. cities and major foreign countries

engineered to expand your output ...AT SAVINGS!

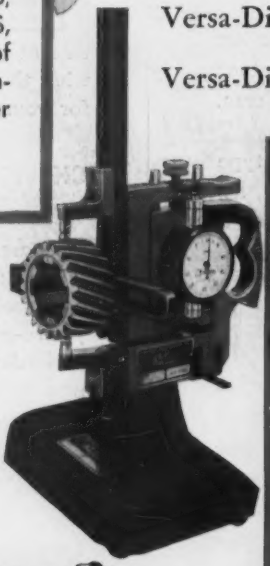
Newer Than NEW!... Versa-Dial

Introducing STANDARD'S new truly all purpose dial unit . . . a simple, easily operated, direct reading instrument, with a potential for nearly all types of INTERNAL and EXTERNAL applications.

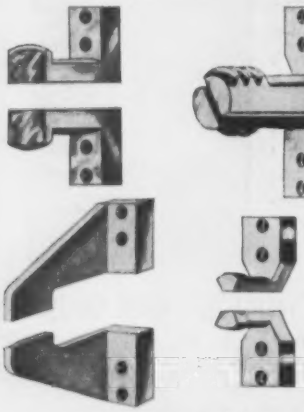
Interchangeable segments permit checking of THREADS for over-all fit, pitch diameter, or lead. Gears for pitch diameter or tooth spacing; also GROOVES, shallow COUNTERBORES, narrow SHOULDERS, BLIND HOLES, etc. . . . an almost unlimited variety of work. The VERSA-DIAL can be converted from one type of job to another in moments.

PATENT PENDING

Versa-Dial **INTERNAL THREAD COMPARATOR**



Versa-Dial **HELICAL GEAR PD COMPARATOR**
mounted on bench stand



Interchangeable Segments

VERSA-DIAL FEATURES

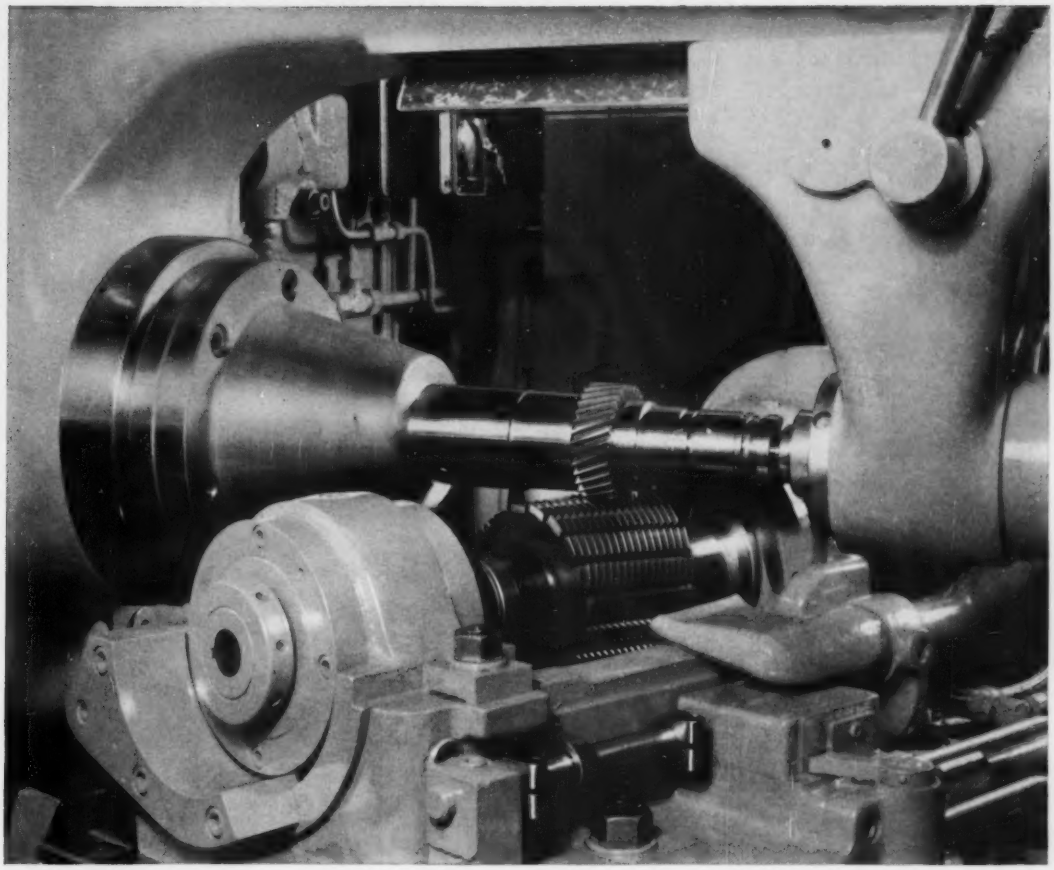
- ★ **EXTREMELY VERSATILE;** good for almost any job
- ★ **EXCEPTIONALLY WIDE RANGE** up to 7" or more
- ★ **QUICK AND EASY TO SET-UP** for long or short runs
- ★ **RAPID LOADING;** easy to operate
- ★ **LONG LIFE;** minimum contact wear

Segments are secured in T-Slots at desired spacing . . . movable segment actuates dial indicator, giving direct reading of variations from basic size. Movement is straight; unusually smooth and precise . . . ideal for gaging.

Versa-Dial **EXTERNAL THREAD COMPARATOR**

STANDARD Gage Co., Inc.
Poughkeepsie, N.Y.

For more information on products advertised, use Inquiry Card, page 245



HIGH-SPEED HOBBING

INCREASES PRODUCTION AND TOOL LIFE

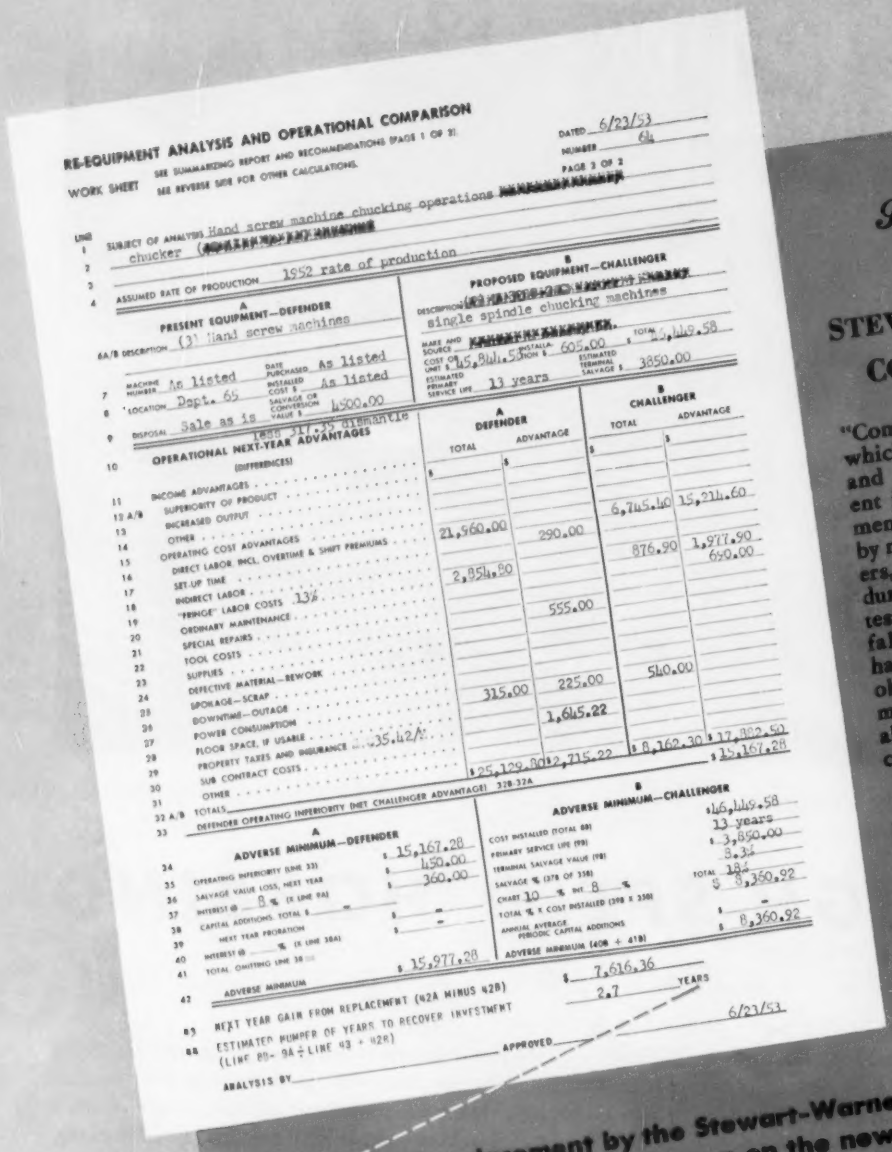
The Barber-Colman No. 14-15 Hydraulic Hobbing Machine is being used in several plants for hobbing of steel gears at speeds of approximately 300 SFM with an increase in both production and tool life. Although these speeds have not been considered practical until recently, the size, power and rigidity of the No. 14-15 Machine make it ideal for high-speed hobbing. Even with a standard hob slide, speeds of 300 SFM with a 5″ hob are possible. However, most machines for high-speed hobbing are equipped with a special heavy-duty, high-speed hob swivel.

The high-speed hob swivel is capable of speeds up to 950 RPM and is designed to accommodate hobs up to 7″ diameter. The extra size and weight of this swivel provide the rigidity to maintain accuracy at high speeds. It is equipped with super-precision ball or tapered roller bearings. An automatic hob shifter may be furnished as extra equipment. High-speed hob swivels may be installed on recent machines in the field.

BUILDERS OF PRECISION GEAR

MACHINES DESIGNED TO MEET YOUR NEEDS ROCKFORD, ILLINOIS, U.S.A.

How the STEWART-WARNER CORPORATION reduces their cost savings opportunities to careful analysis



RE-EQUIPMENT ANALYSIS AND OPERATIONAL COMPARISON

WORK SHEET — SEE SUMMARIZING REPORT AND RECOMMENDATIONS (PAGE 1 OF 2). SEE REVERSE SIDE FOR OTHER CALCULATIONS.

DATED 6/23/53 — NUMBER 64 — PAGE 2 OF 2

LINE 1 SUBJECT OF ANALYSIS: Hand screw machine chucking operations [redacted] chucker ([redacted])

2 ASSUMED RATE OF PRODUCTION: 1952 rate of production

	A PRESENT EQUIPMENT—DEFENDER	B PROPOSED EQUIPMENT—CHALLENGER
6A/B DESCRIPTION	(3) Hand screw machines	[redacted] single spindle chucking machines
7 MACHINE NUMBER	As listed	DATE PURCHASED: As listed
8 LOCATION	Dept. 65	INSTALLED COST $: As listed
9 DISPOSAL	Sale as is	SALVAGE OR CONVERSION VALUE $: 4500.00
		MAKE AND SOURCE: [redacted]
		COST OF UNIT $: 6,845.60 — INSTALLATION $: 605.00 — TOTAL $: 7,449.58
		ESTIMATED PRIMARY SERVICE LIFE: 13 years — ESTIMATED TERMINAL SALVAGE $: 3850.00

Lease 317.24 dismantle

10 OPERATIONAL NEXT-YEAR ADVANTAGES (DIFFERENCES)	A DEFENDER TOTAL $	A DEFENDER ADVANTAGE $	B CHALLENGER TOTAL $	B CHALLENGER ADVANTAGE $
11 INCOME ADVANTAGES				
12 A/B SUPERIORITY OF PRODUCT				
13 INCREASED OUTPUT			6,745.60	15,214.60
14 OTHER				
15 OPERATING COST ADVANTAGES	21,960.00	290.00	876.90	1,977.90
16 DIRECT LABOR INCL. OVERTIME & SHIFT PREMIUMS				650.00
17 SET-UP TIME	2,854.90			
18 INDIRECT LABOR				
19 "FRINGE" LABOR COSTS 13%		555.00		
20 ORDINARY MAINTENANCE				
21 SPECIAL REPAIRS				
22 TOOL COSTS				
23 SUPPLIES				
24 DEFECTIVE MATERIAL—REWORK				
25 SPOILAGE—SCRAP	315.00	225.00	540.00	
26 DOWNTIME—OUTAGE		1,645.22		
27 POWER CONSUMPTION				
28 FLOOR SPACE, IF USABLE 35.42/ft.				
29 PROPERTY TAXES AND INSURANCE				
30 SUB CONTRACT COSTS				
31 OTHER				
32 A/B TOTALS	$25,129.80	$2,715.22	$8,162.30	$17,842.50
33 DEFENDER OPERATING INFERIORITY (NET CHALLENGER ADVANTAGE) 32B-32A				$15,127.28

	A ADVERSE MINIMUM—DEFENDER		B ADVERSE MINIMUM—CHALLENGER	
34	OPERATING INFERIORITY (LINE 33)	$ 15,127.28	COST INSTALLED (TOTAL 6B)	$ 7,449.58
35	SALVAGE VALUE LOSS, NEXT YEAR	$ 450.00	PRIMARY SERVICE LIFE (9B)	13 years
36	INTEREST @ 8 % (% LINE 9A)	$ 360.00	TERMINAL SALVAGE VALUE (9B)	$ 3,850.00
37	CAPITAL ADDITIONS, TOTAL $ —	$ —	SALVAGE % (37B OF 35B)	8.3%
38	NEXT YEAR PRORATION	$ —	CHART 10 % INT. 8 %	TOTAL 18%
39	INTEREST @ % (% LINE 38A)		TOTAL % X COST INSTALLED (39B X 35B)	$ 1,350.92
40	TOTAL OMITTING LINE 38		ANNUAL AVERAGE PERIODIC CAPITAL ADDITIONS	$ —
41			ADVERSE MINIMUM (40B ÷ 41B)	$ 1,350.92
42	ADVERSE MINIMUM	$ 15,977.28		

43 NEXT YEAR GAIN FROM REPLACEMENT (42A MINUS 42B) $ 7,616.36

44 ESTIMATED NUMBER OF YEARS TO RECOVER INVESTMENT (LINE 8B- 9A ÷ LINE 43 + 42B) 2.7 YEARS

ANALYSIS BY _____ APPROVED _____ 6/23/53

Statement from

STEWART-WARNER CORPORATION

"Comparisons such as this, which prove out the economy and efficiency values inherent in technological betterments as they are announced by machine tool manufacturers, — are standard procedure with us. We apply this test constantly; it is an infallible guarantee against harboring, unknowingly, an obsolete machine. It is our most useful tool for keeping abreast, as well as for keeping competitive."

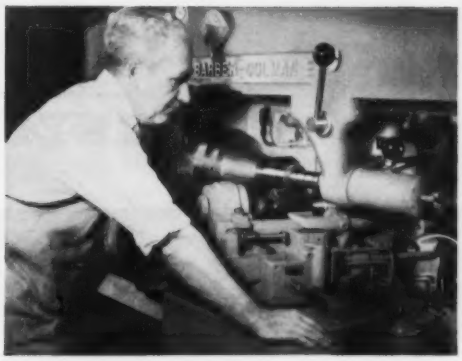
DAVID C. PETERSON
Vice President
Director of Engineering & Manufacturing, Division One, Stewart-Warner Corporation.

GAIN from replacement by the Stewart-Warner Corporation formula is
. . . after required interest or return on the new investment
. . . after full allowance (by the formula) for future obsolescence of the new equipment

ROCKFORD INSERT GROUP

Keep Gathering Metal-Working Production Ideas . . . Be Well Informed When the Time for Replacement Arrives

December, 1954



The jobs shown here indicate at least 200% increase in production, 100% better tool life, greater profile accuracy and equal or improved surface finish on the hobbed gears, hobbing at speeds of 300 SFM or greater. Using ground and unground hobs, gears were cut from a wide range of steels as high as 207 Br. hardness.

FIRST SERIES OF TESTS

GEAR		STANDARD HOB SWIVEL		HIGH-SPEED HOB SWIVEL		% INCREASE	
DP	No. Teeth	Cutting Time at 135 SFM	Pieces Per Shift	Cutting Time at 326 SFM	Pieces Per Shift	Prod.	Tool Life
6	36 Spur	10.64 min.	72	4.2 min.	161	253%	223%
6	35 Spur	11.62 min.	72	4.5 min.	151	258%	209%
8	55 Helical	15.14 min.	50	6.94 min.	105	218%	210%
8	62 Helical	26.8 min.	28	10.3 min.	72	260%	257%

Double Thread Hob, 5x5x2
Steel — AISI 8620 normalized
Feed — .060"/rev.
No difference in surface quality
Profile and lead angle above average accuracy

SECOND SERIES OF TESTS

HOB	GEAR	SPEED	FEED
Accurate Unground 9 D.P. 3-Thd. 5x5x2	22 Teeth, Helical SAE 5135 170-207 BHN	307 SFM	.045"/rev.
Same	Same	307 SFM	.070"/rev.

Climb Hobbing
Material — AISI 5135
Average lead error—at .070" feed within .0006" in 13/16"
Total Composite Error—.002" both feeds
Estimated Hob Life—200 per sharpening
Using same speed and feeds with conventional hobbing, resulting finish was not as good.

Although high-speed hobbing of steel gears is not used extensively as yet, it is used on enough jobs to prove that it is applicable under the proper conditions. Tests indicate that tool life increases until a speed of 200 SFM is reached, and then drops off rapidly to a speed of 250 SFM. After 250 SFM, however, hob life increases again until it is equivalent or better at 300 SFM than at 200 SFM. Materials on which satisfactory results have been produced include AISI 1113, 8620, 5135 and 4140.

Our Engineers have been working with our customers on high-speed hobbing and have helped to solve many problems. They will be glad to discuss the economy of high-speed hobbing to your specific job if you will submit your part print and production requirements to them.

Call your Barber-Colman representative or write direct to:

HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES

BARBER COLMAN

Barber-Colman Company

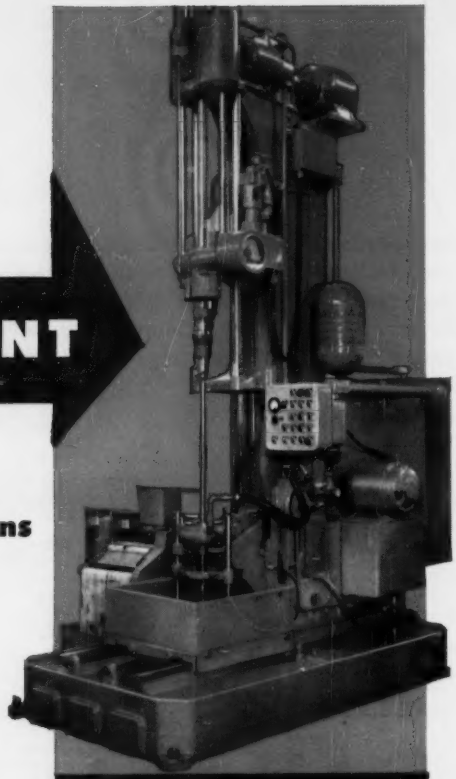
GENERAL OFFICES AND PLANT, 6212 ROCK STREET, ROCKFORD, ILLINOIS

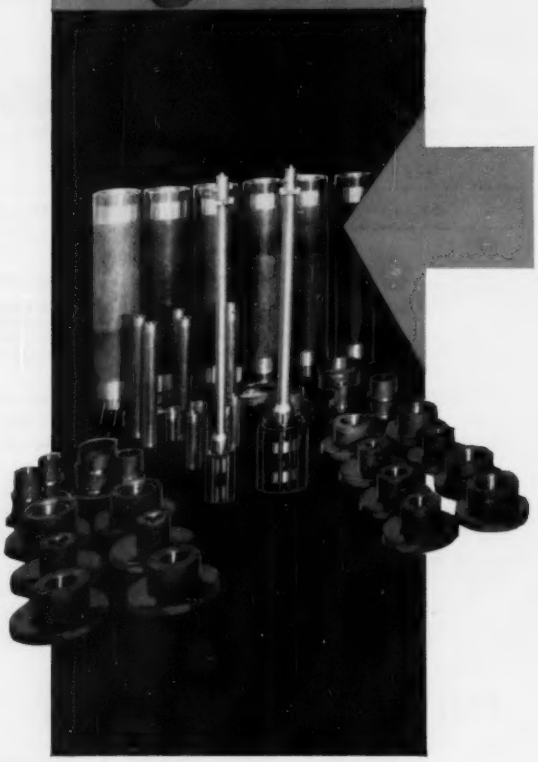
HOBS AND MACHINES SINCE 1911

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

BARNESDRIL

HONING EQUIPMENT





reduces finishing costs
on medium production runs
TOO!

Production honing with Barnesdril Equipment needn't be limited to long-run, high-output operations as one major, mid-western metalworking plant has discovered. The wide variety of parts shown here are all produced on *one* machine . . . a Model 307-C Single Spindle Honer . . . equipped with a universal fixture and *runs are of medium length,* yet each piece is:

Finished To Specifications

Electronic Hone Expansion Control combined with the correct selection of abrasive, in the form of "Extra-Deep" Plas-T-Clad stones provides finishes of specified R.M.S.

Produced At Minimum Cost

Electronic Control of the hone minimizes rejects. Plas-T-Clad stones provide 200 to 500% more abrasive life . . . reduce down-time for stone replacement. The universal fixture with inter-changeable locators and adapters positions work quickly.

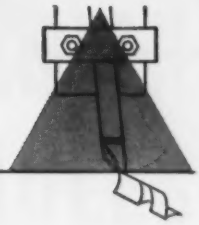
The length of the run is not important, so ask your Barnesdril Honing Engineer to show you where *production honing on a planned* basis can reduce your hole-finishing costs.

HOLE BARNESDRIL FINISHING

BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS

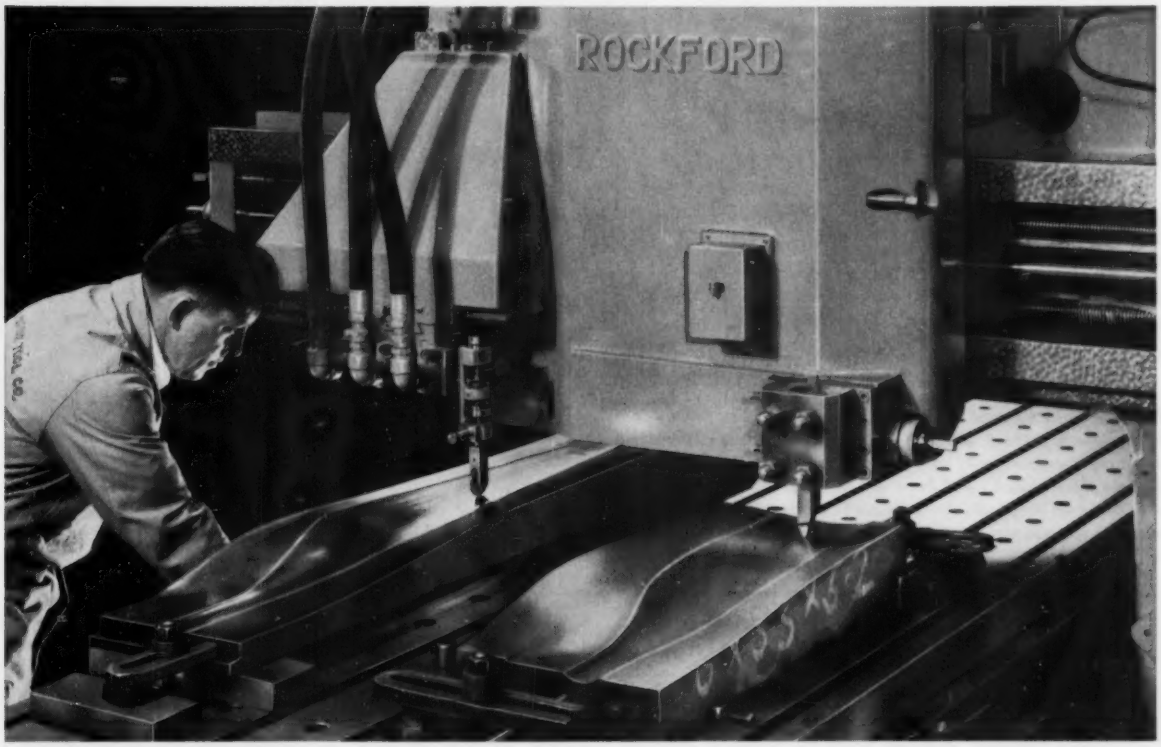
CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**



a cost cut . . . with every stroke

of rockford kopy-kat hydraulic

duplicators



higher production is obtained with every stroke **because...**

the unique Kopy Kat duplicates automatically. Its hydraulic duplicator valve is so sensitive, so exact, that positive duplication of complex forms is done with the ease of straight-production machining.

Ask us for recommendations for your duplicating shaping, planing, slotting and turning work.

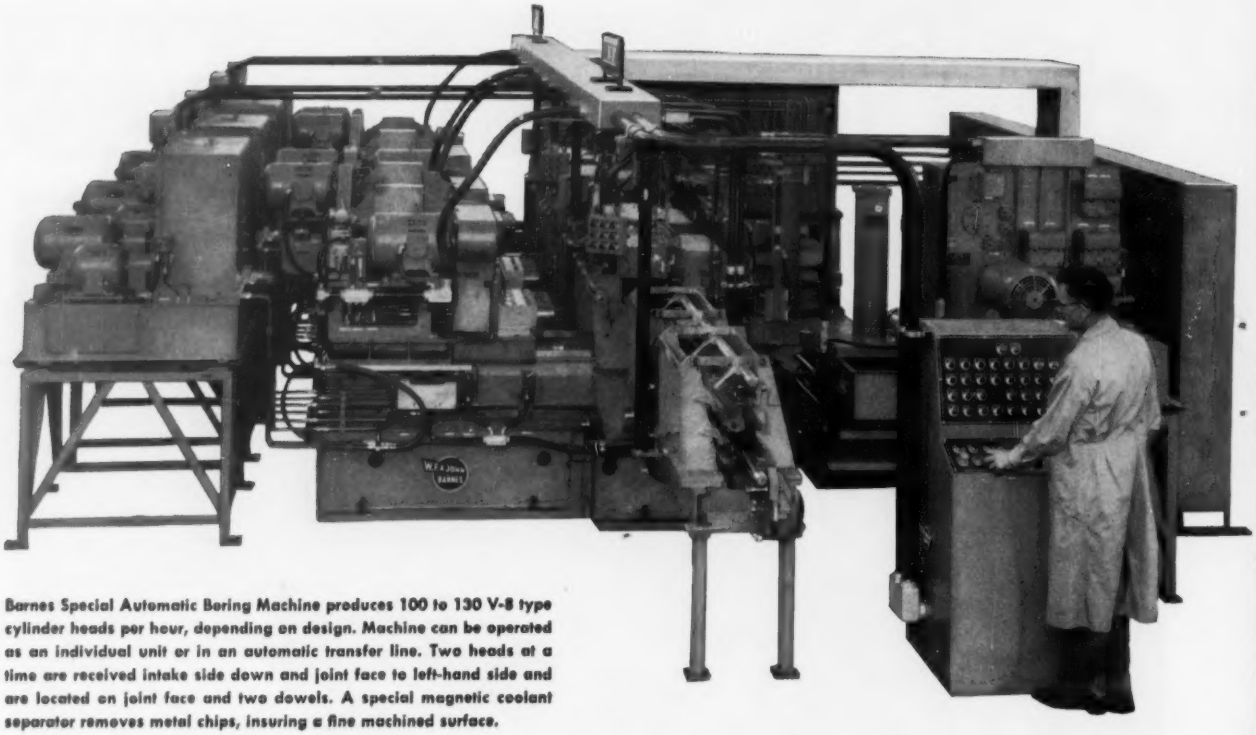
OUR 52nd YEAR

ROCKFORD MACHINE TOOL CO.

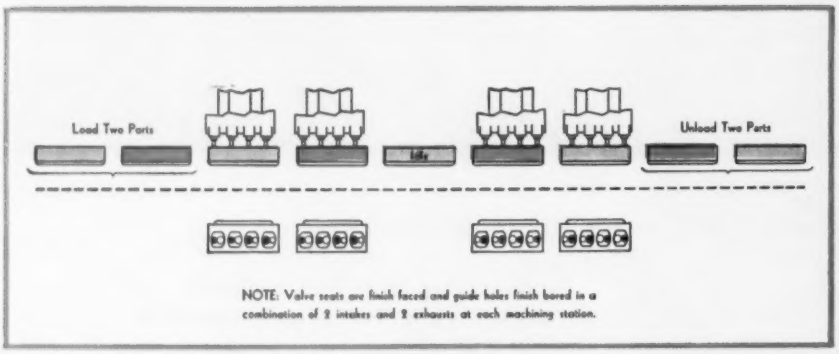
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

Announcing NEW MACHINING AUTOMOTIVE

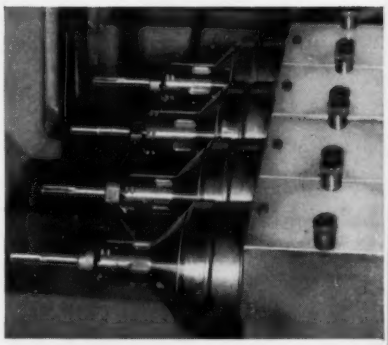


Barnes Special Automatic Boring Machine produces 100 to 130 V-8 type cylinder heads per hour, depending on design. Machine can be operated as an individual unit or in an automatic transfer line. Two heads at a time are received intake side down and joint face to left-hand side and are located on joint face and two dowels. A special magnetic coolant separator removes metal chips, insuring a fine machined surface.



NOTE: Valve seats are finish faced and guide holes finish bored in a combination of 2 intakes and 2 exhausts at each machining station.

Diagram above illustrates how heads are transferred two at a time and machining operations arranged to meet high output requirements. For lower production, machines are designed with fewer machining stations and one-station transfer unit.



Closeup of 4-spindle head with special tools for machining four valve seats and stem holes in one pass. Second 4-spindle head completes remaining operations.

W. F. & JOHN BARNES

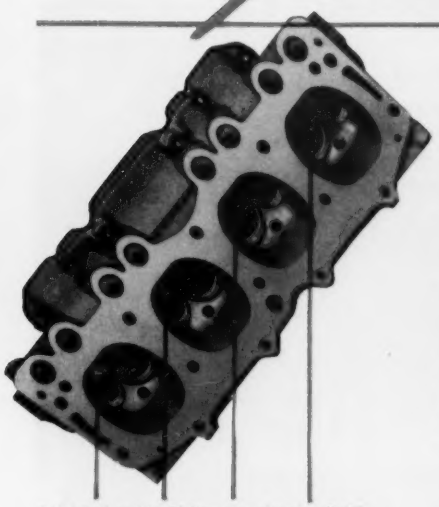
Builders of Better Machines Since 1872

MULTIPLE SPINDLE DRILLING • BORING • TAPPING

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

PRECISION METHOD OF FINISH VALVE SEATS AND STEM HOLES

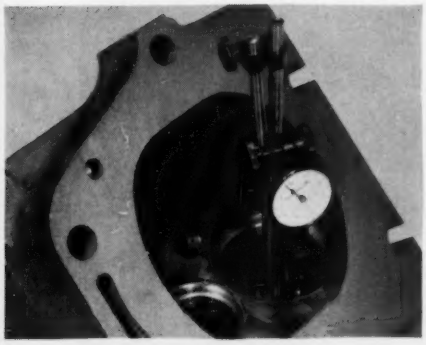
Automatically



Cylinder head for V-8 engine showing finish machined valve seats and guide holes. Red arrows indicate operations performed at first machining station.

EXCLUSIVE W. F. & JOHN BARNES MACHINING DEVELOPMENT HOLDS TOTAL CONCENTRICITY WITHIN .0005"

Now, a new precision machining method developed exclusively by W. F. & John Barnes makes it possible for you to finish machine automotive valve seats and stem holes on a continuous automatic basis. You can now eliminate corrective operations after normal boring, reaming, and seating operations, because this new development holds total concentricity within .0005" (total indicator reading). This new machining process, as incorporated into Barnes Automatic Progress-Thru Type Machines, consists of multi-blade tooling for the valve seating operations, combined with modified gun drilling tools for precision boring valve guide holes. Production tests show the valve seat tools produce 10,000 to 15,000 parts, and the boring tools, between 2,500 and 4,000, before regrinding or replacement is necessary. The net result has increased production efficiency and improved product quality at lower cost. Write for more facts today.



Concentricity of valve seat and stem hole held to .0005" total indicator reading.

TO SAVE TIME INVESTIGATE BARNES' 6-POINT MACHINE TOOL BUILDING SERVICE

For over 75 years, Barnes has designed and built special machinery. These years of experience can assist you in saving time and cutting costs. Check the advantages of an engineering and building service from one convenient source.

1. **SPECIALIZED MANUFACTURING FACILITIES**—75-year background, large well equipped plant efficiently tooled to build high production machines.
2. **SPECIAL HYDRAULIC EQUIPMENT**—designed and built to meet JIC standards. Individually engineered units assure smooth, dependable actuation for every requirement.
3. **SPECIAL ELECTRICAL EQUIPMENT and CONTROLS** — individually designed and built for maximum safety and ease of control, with circuits that assure the most dependable coordination of all machine functions.
4. **SPECIAL GAUGES, FIXTURES, TOOLS**—designed for each individual machining problem, assure accuracy of operations at high production speeds.
5. **SPECIAL HANDLING AND CONVEYOR EQUIPMENT**—designed and built to reduce work handling, effect maximum safety and efficiency.
6. **COORDINATED DESIGN AND ENGINEERING**—Mechanical, Hydraulic, Electrical, Process, Tool, and Fixture Engineers work together at Barnes. Team-work solves complex problems quickly.

WRITE FOR FREE BOOKLET

Ask for free booklet "Coordinated Machine Engineering" describing the scope of Barnes machine tool building service.

W. F. & JOHN BARNES COMPANY
310 SOUTH WATER STREET, ROCKFORD, ILLINOIS

MACHINES • AUTOMATIC PROGRESS-THRU AND TRANSFER TYPE MACHINES

FOR PRODUCTION MACHINE TOOLS IT'S ROCKFORD, ILLINOIS, U.S.A.

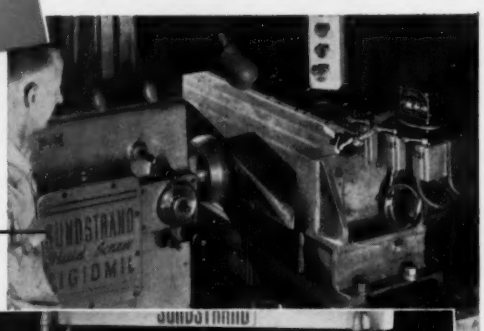
Get Profitable Methods *plus* Advanced Machine Design

from . . .

SUNDSTRAND "Engineered Production" Service

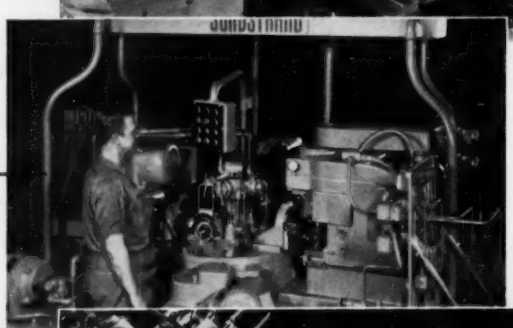
Here are some representative examples of machine tools and services offered by the Machine Tool Division of Sundstrand. Standard basic machine designs and units, coupled with methods engineering assistance, have resulted in many cost-saving Sundstrand installations. If you have metal working operations in your plant and are interested in lowering manufacturing costs, call in a Sundstrand representative. He'll be glad to assist you in obtaining more economical methods. There is no obligation for this service.

High Production Methods On Low Production Jobs



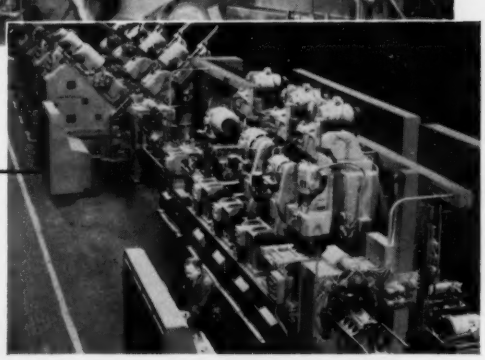
Using a Sundstrand Model 33 Rigidmil and universal magnetic fixture for machining tool blocks, cam bars, motor bracket slides, etc. reduced the time on the average of 50% over the previous method. Lot sizes varied from 1 to 25 pieces.

Multi-Station Automatic Indexing Machine



Here is a Sundstrand Special Four Station Process Machine for milling slots in piston retainers. The part is located and clamped at station #1 and then indexed thru the remaining three stations to complete the machining with one handling of the part. All units are interlocked with the index table for automatic operation at a production rate of 180 pieces per hour.

Multi-Station Automatic Transfer Rigidmil

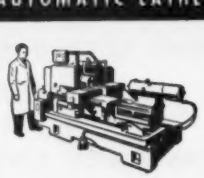


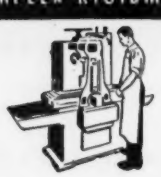
Here is an interesting example of Sundstrand "Engineered Production" as applied to interlocking several machine elements into continuous flow production. It is a Sundstrand special purpose 29 station transfer or process type machine designed and built to drill and ream locating holes, mill bearing sides and odd pads on cylinder blocks. Controls are operated from a floor mounted console type control station.

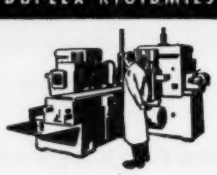
SUNDSTRAND "Engineered Production" Service*

*REG. U.S. PAT. OFF.

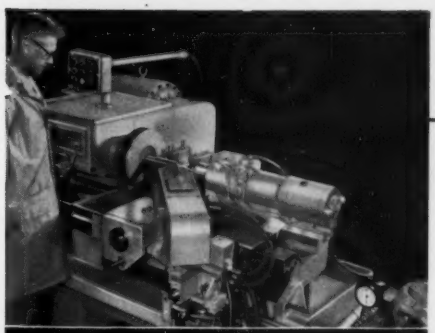
AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS





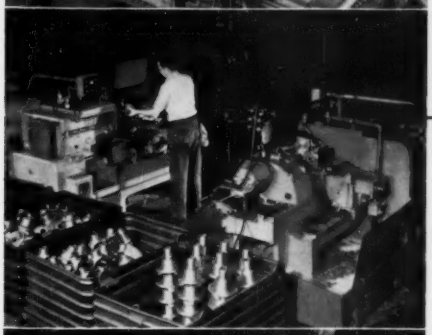


MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



Tracer Turning

For multi-cycle single point turning of irregular shapes, Sundstrand Automatic Lathes can be provided with a template controlled tracing slide mounted to the regular front carriage. With this attachment and controls, ruff, semi-finish and finish cuts can be taken with one turning tool in an automatic cycle. The regular rear slide can be used to square up shoulders, chamfer, etc.



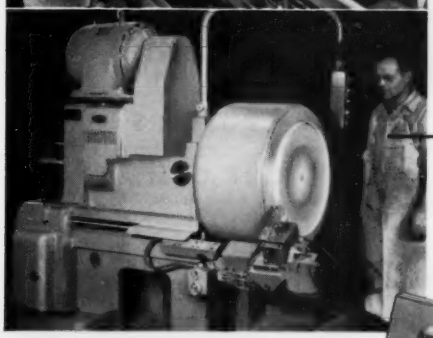
Small Lot Turning With Multiple Tooling

Illustrated at left are two Sundstrand Automatic Lathes used for turning various sizes of yoke parts in lot sizes of 500 or less. Production was increased more than 5 times compared to the former method. Changeover time is 25% less than with former equipment.

Hopper Loading For Production Turning

This Sundstrand Model 8A Automatic Lathe turns and chamfers three different lengths and diameters of master track link pins. Operator loads parts into a hopper loader and automatic machine cycle is started with chucking of part.

When machine cycle is completed, a work ejector pushes the pins out of the chuck and into the unloading vee. Machine will run automatically with one filling of the hopper for approximately 10 minutes.



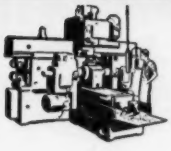
Special Turning

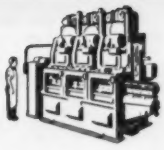
The Sundstrand special short bed lathe illustrated at the left is used for turning and facing the open end of a washing machine tub. The short bed permits easy end loading and unloading to maintain a production of approximately 85 pieces per hour.

FREE DATA

Additional information on the complete line of Sundstrand machines is available. Ask for bulletin S.P. 650.

TRIPLEX RIGIDMILS | SPECIAL MACHINES





SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

GREENLEE *Automatics*

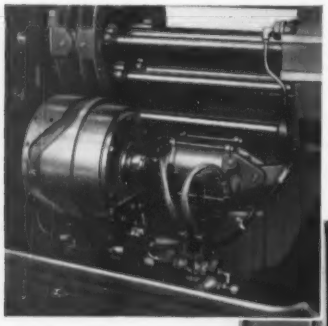
Close-up of the rear stock reel support, showing a piston (which follows and pushes the stock) being inserted in a stock tube. The air hoses are equipped with speed couplers.

AIR-FEED

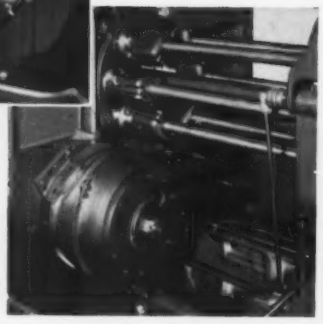
(PNEUMATIC STOCK FEED)

This method of feeding out stock was developed primarily for the many screw machine jobs that require either multiple feed-out arrangements, greater feed-out length than the conventional mechanical arrangement will permit, or for machining parts made from ground stock where pusher marks would be objectionable. It can be adapted to all 1" and 1⅛" GREENLEE Automatics.

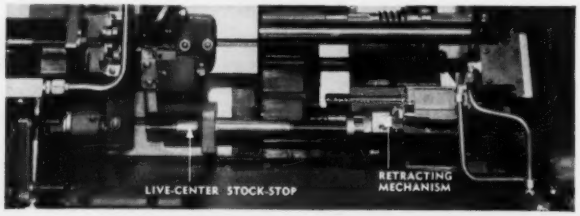
- FEEDS OUT STOCK TO 16½"
- PROVIDES MULTIPLE FEED-OUT
- ELIMINATES STOCK SCORING
- REDUCES STOCK REEL NOISE
- ELIMINATES STOCK PUSHERS
- ELIMINATES FEED-OUT CAMS



Left: One method of opening and closing the collets for multiple feed-out. The air cylinder, controlled by a plate cam on the cam drum, actuates the collet-operating rings. Various arrangements can be made, depending on the requirements of the particular job being set up.



Right: Simplification of the feed cam drum possible with air feed, where the collets are to be opened by the conventional mechanical arrangement between the 6th and 1st positions. Feed-out is usually against a standard fixed stop stock in such cases.



Above: A method used for feeding out stock during the machining cycle. The stock is fed out against an adjustable live-center stock-stop arrangement. When the collet jaws are closed, the live-center retracts and permits the stock to rotate freely and index to the next position.

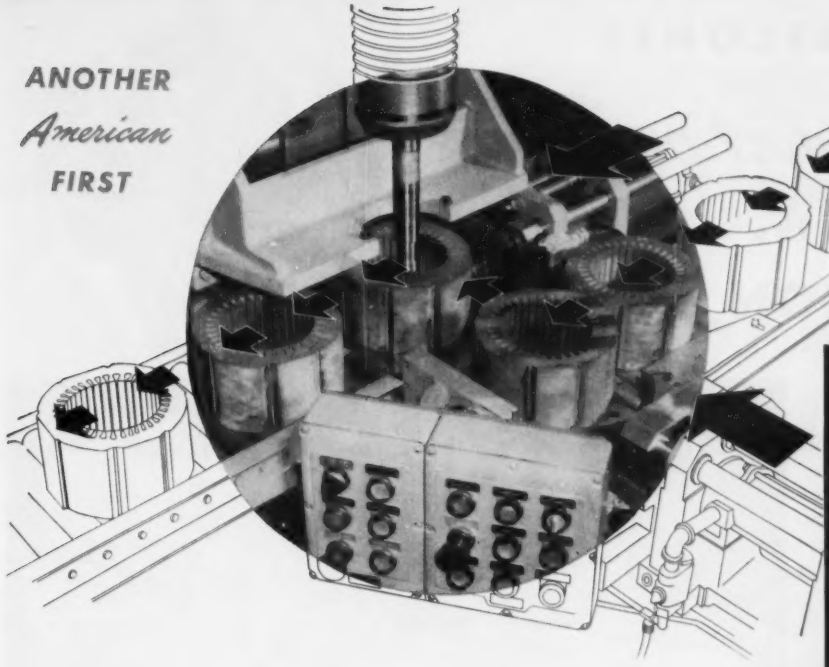
Write for Free Literature

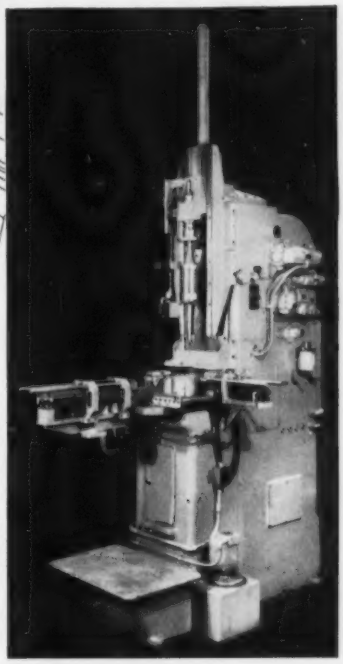
PRODUCTION MACHINERY
GREENLEE

GREENLEE BROS. & CO., 1872 MASON AVE., ROCKFORD, ILL.

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

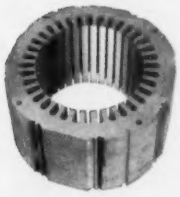
ANOTHER
American
FIRST





...completely AUTOMATED BROACHING

STATOR PARTS BROACHED IN 20 SECONDS



Installed in a conveyor line, this American 3-way broaching machine with a hydraulic broach retriever and electrical controls, broaches the I.D. of stator parts in a 20 second cycle. Parts coming into the machine are automatically shuttled into position, broached, and then discharged back on the conveyor line. Interchangeable broach arbors and broach shells make it possible to broach several different parts of similar size.

BEVEL GEAR BLANKS BROACHED IN 15 SECONDS

Using tooling similar to that illustrated, an American (PD) pull-down machine, installed in a conveyor line, automatically broaches the I.D. of a bevel gear blank in 15 seconds. By using interchangeable broach arbors and broach shells, over 20 similar bevel gear blanks are broached with this set-up.

FOR AUTOMATED
OR INDIVIDUAL
BROACHING PROBLEMS
— SEE *American*

American approaches each broaching problem as part of the complete production cycle. Broaches, fixtures and machines — all designed and built by American — provide a complete broaching service. Let American help you cut your production costs. Send part print or sample to get the solution to your broaching problem. *Ask for Catalog No. 450.*

AMERICAN *American* BROACH & MACHINE CO.
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.
American Building - Ann Arbor, Michigan
See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

SUNDSTRAND

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

Downtime BECOMES *Production Time*

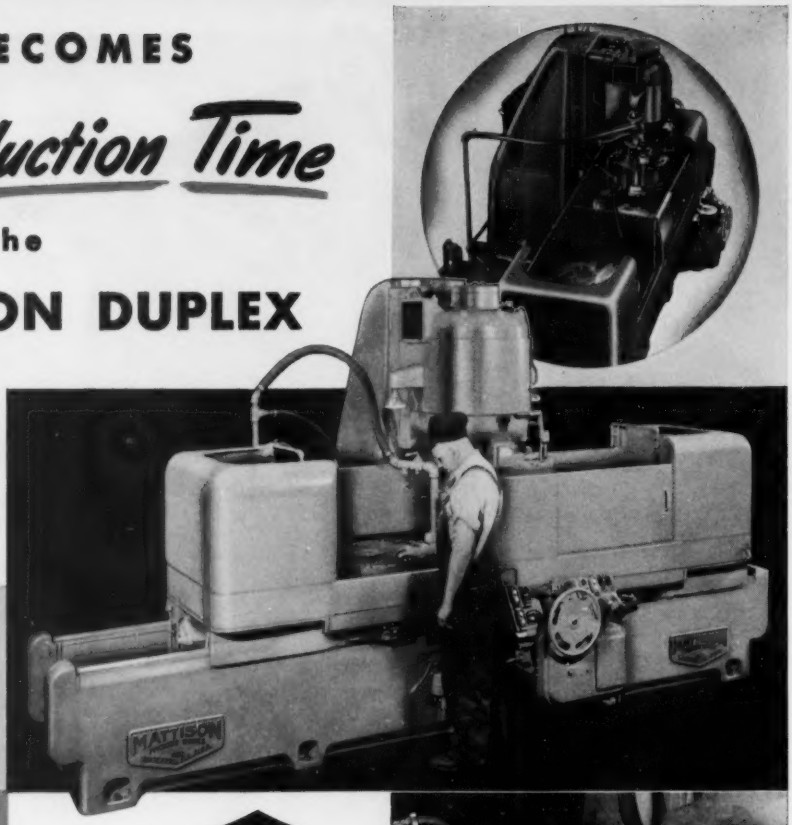
with the

NEW MATTISON DUPLEX

Take a look at **THIS**

~~2 Operators~~
~~2 Standard Grinders~~
~~500 Pieces~~

1 Operator
1 Mattison Duplex
500 Pieces



● That's what happened at The Ingersoll Milling Machine Co., where modern shop equipment is playing an important part in meeting greatly increased requirements for Ingersoll milling cutter blades.

They say "The pieces being ground in these pictures are Maxel steel shanks for carbide-tipped milling cutter blades.

On these particular blade shanks, .050 stock is removed on the Mattison Duplex. A wide variety of blades and shanks are ground on this machine, with stock removal ranging from .020 to .200.

The two Mattison Duplex machines which replaced three single-table standard type grinders are doing more work than the three replaced machines. By placing a single ring of blades around the outside of the 30″ diameter chuck, the operator is able to maintain continuous grinding. If more blades were put on the table at one time, the blades on the other table would be finished before he was ready to unload them.

The time saving in rough grinding these blades on the new Duplex machines is 50 per cent, compared with the old machines. In other words, 500 blades can be produced in half the time formerly required. Greater power and faster action account for some of this difference.

The new Mattison Duplex Grinder is really two machines in one, being equipped with two rotary tables or chucks instead of one. On many classes of work, one operator with this machine can turn out as much work as was formerly done by two machines and two operators. See example to the left. Downtime is practically eliminated.

An analysis of your grinding work will very likely disclose many jobs that could be very profitably handled on a Mattison Duplex. For further information write for a free copy of 145-3RM our new circular on this machine.

MATTISON MACHINE WORKS

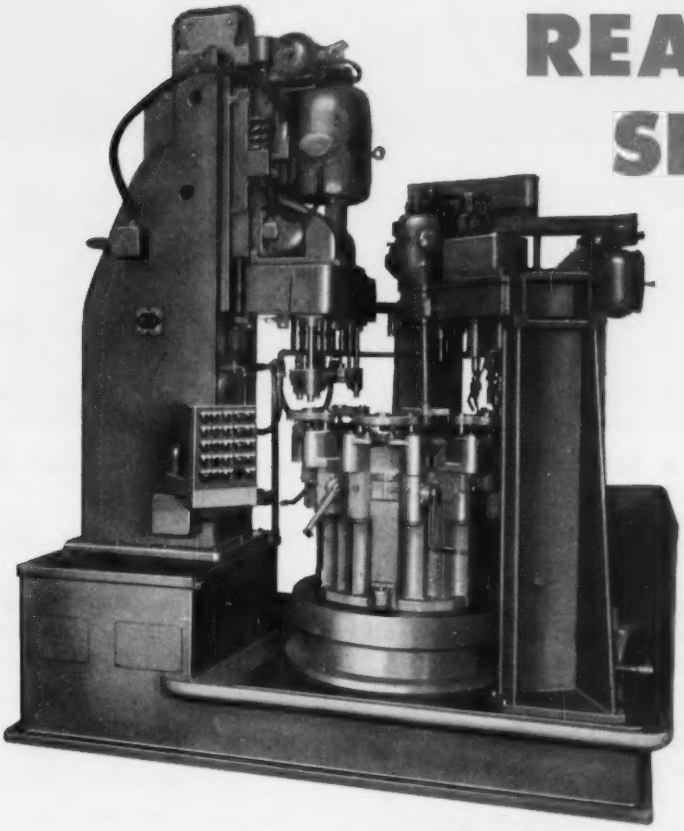
ROCKFORD · ILLINOIS

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

Rehnberg-Jacobson

AN IDEAL TYPE OF MACHINE FOR MANY KINDS OF WORK . . .

This machine has a place in one of the largest mass-production plants in the country. It performs a series of operations that would not be economical on a bigger or more complex machine. A "special" machine of this uncomplicated type is ideal for the purpose, and has many advantages over using a group of standard machines for the same operations even though it performs only "standard" work. *There are many, many instances where a "special" machine like this can be used to advantage in our metalworking industries today.*



REAR AXLE SHAFTS

The flanges of rear axle shafts are drilled and tapped on this Six-Station, ALL-MECHANICAL, Automatic-Index machine. The operations are: drilling eight .660" holes and countersinking *both ends* of these holes, drilling and countersinking and tapping two 3/8"-16 holes, and drilling (in two stages) one 1.213" hole. *Standard* R-J ALL-MECHANICAL Drill, Tap, and Index Units are used, on a simple but sturdy structure, with all necessary electrical controls. Production capacity is 120 pieces per hour.

ALWAYS BE SURE TO CHECK WITH REHNBERG-JACOBSON ON THE POSSIBILITIES OF PRODUCTION MACHINES OF THIS TYPE FOR YOUR PLANT. WE HAVE PRODUCED MANY INGENIOUS VARIATIONS OF THE BASIC IDEA — TO SERVE SPECIFIED PURPOSES OF GREATER OUTPUT, LOWER COST, IMPROVED ACCURACY, OR ANY COMBINATION.

REHNBERG-JACOBSON MFG. COMPANY

DESIGNERS & BUILDERS OF SPECIAL MACHINERY

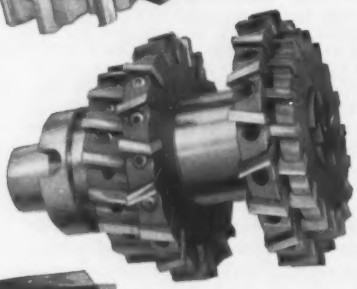
R-J

2135 KISHWAUKEE ST.
ROCKFORD, ILLINOIS

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

INGERSOLL
Replacement Blades

FOR SUPERIOR PERFORMANCE & ECONOMY



Write for Cutter Catalog 608 describing Ingersoll inserted blade face mills, end mills, helical slab mills, side mills, arbor cutters and boring heads.

Good cutting tools require high quality blades. Ingersoll milling and boring cutters give you unequalled performance when equipped with Ingersoll replacement blades. In Ingersoll precision blades you get . . .

- **Special design** to give longer actual cutting life and more grinds per blade.
- **Manufacturing accuracy** to assure proper fit in cutter housing and more effective cutting action.
- **Selected grades** and correct arrangement of carbide for your particular work.
- **Benefits of continuous research** into new metal cutting techniques.

Because they are manufactured on modern, efficient production equipment, superior Ingersoll replacement blades are available at competitive prices.

Most standard Ingersoll carbide-tipped, cast alloy or high speed steel blades are available from stock.

THE INGERSOLL MILLING MACHINE COMPANY
ROCKFORD, ILLINOIS, U. S. A.

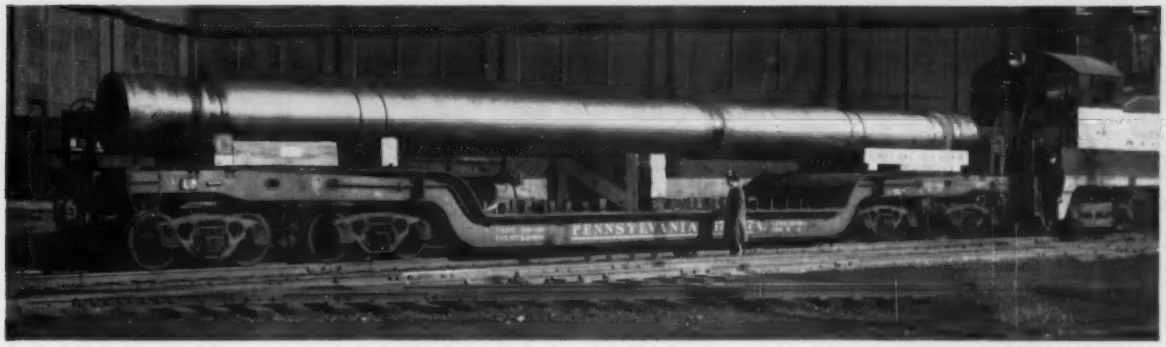
BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES
ORIGINATORS OF SHEAR CLEAR CUTTERS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

BIG ONES

From Forge Shop and Foundry

Some of the biggest forgings and castings made in the world come out of the Bethlehem shops, and many of them are impressive things to see. For example, that massive steel column on the freight car. It is just one inch shy of 70 ft long and weighs 155 tons. For an idea of the size, look at the man standing alongside the railway car. It would take twelve of him, laid end to end, to match the length of the forging.



The big cast sheave wheel isn't exactly a peewee, either. Even though it weighs "only" 30 tons, it's still a mighty big casting. Some intricate work in that piece, and it's typical of the many huge and complex shapes that Bethlehem makes each year.

Down at the other end of the scale, sizewise, are the products of Bethlehem's drop forge shops. Some are so small they can easily be held in the palm of your hand, or balanced on a fingertip. Others take muscle to lift; the 69-pounder shown on this page is a fairly hefty specimen.

Your own needs may fall between the extremes of large and small. But whatever your requirements in forgings or castings, by all means check with Bethlehem. We are equipped to do the job you want . . . whether the pieces are heavy tonnage, or in the medium or lightweight brackets.

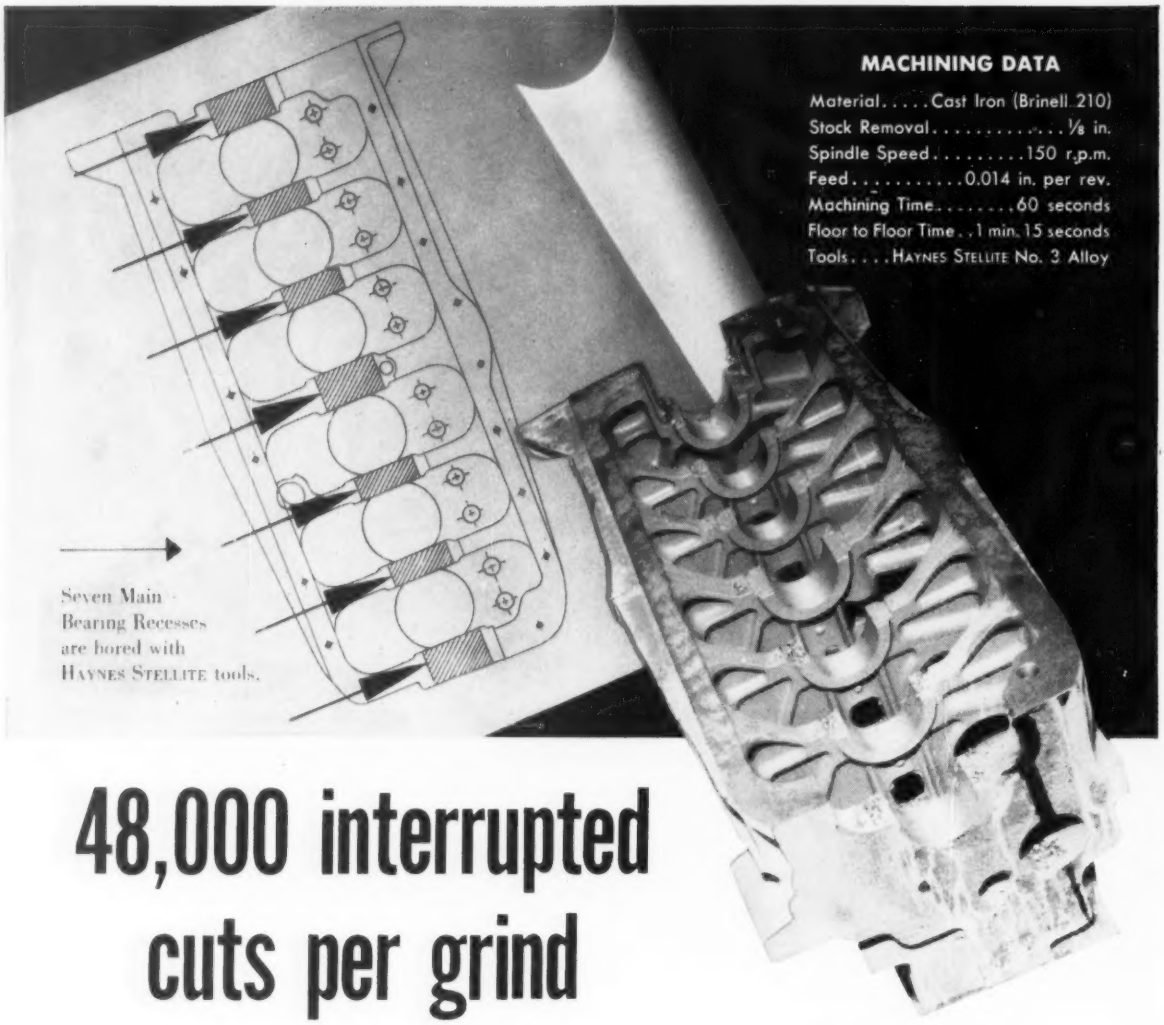
Compared to the big press forgings and heavy castings, drop-forged pieces are flyweights. But they're an important item at Bethlehem shops, which have turned out millions of them.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM FORGINGS and CASTINGS


MACHINING DATA
Material. . . . . Cast Iron (Brinell 210)
Stock Removal. . . . . ⅛ in.
Spindle Speed. . . . . 150 r.p.m.
Feed. . . . . 0.014 in. per rev.
Machining Time. . . . . 60 seconds
Floor to Floor Time . . 1 min. 15 seconds
Tools. . . . HAYNES STELLITE No. 3 Alloy
Seven Main Bearing Recesses are bored with HAYNES STELLITE tools.

48,000 interrupted cuts per grind

HAYNES STELLITE tools machine the main bearing recesses in 320 cast iron engine blocks between grinds. Each of 14 tools used in the set-up makes 150 interrupted cuts in each block . . . a total of 43,000 interrupted cuts per grind. The tools remain in operation for a full eight-hour shift, without chipping or spalling. Other tools tested on this job chipped under the constant hammering of the intermittent cuts, and had to be replaced in less than an hour.

Standard tool bits ⅜ in. square and 2 in. long, made of HAYNES STELLITE alloy No. 3, are used for this operation. Only 0.015 in. of metal has to be removed when the tools are sharpened, and the tools can be reground about 30 times. Then, when they are too short to be used for boring the main bearings, they are used to machine the smaller cam bearing recesses. In this second operation the same tools can be reground about 50 times more!

There are four grades of HAYNES STELLITE metal-cutting tools varying in hardness, compressive strength, and impact resistance. For a complete description of properties, sizes, and recommended operating data, write for the free booklet, "HAYNES STELLITE Metal-Cutting Tools."

HAYNES TRADE-MARK ALLOYS

HAYNES STELLITE COMPANY

A Division of Union Carbide and Carbon Corporation

UCC

General Offices and Works, Kokomo, Indiana

Sales Offices

Chicago · Cleveland · Detroit · Houston · Los Angeles · New York · San Francisco · Tulsa

"Haynes" and "Haynes Stellite" are registered trade-marks of Union Carbide and Carbon Corporation

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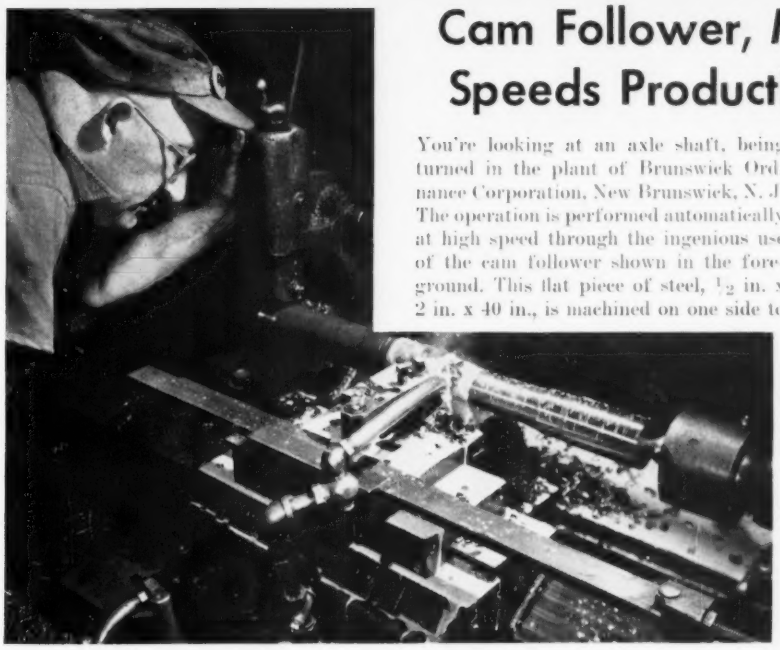
Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributors: Bethlehem Steel Export Corporation



Cam Follower, Made of Lehigh H, Speeds Production of Axle Shafts

You're looking at an axle shaft, being turned in the plant of Brunswick Ordnance Corporation, New Brunswick, N. J. The operation is performed automatically at high speed through the ingenious use of the cam follower shown in the foreground. This flat piece of steel, $\frac{1}{2}$ in. x 2 in. x 40 in., is machined on one side to the contour of the finished shaft. It moves parallel to the rough bar, making contact with a wheel, beneath the coolant pipe, which in turn actuates the carbide bit.

Engineers at the Brunswick plant needed a steel with good machinability for the cam follower. But above all, they wanted maximum resistance to wear. Which steel did they choose? Lehigh H, our special-purpose high-carbon, high-chromium tool steel.

Lehigh H, an air-hardening steel, is ideal wherever good machinability, maximum wear and minimum distortion are important. It's safe for intricate dies having sharp corners. What's more, it's a deep-hardening steel, with high compressive strength.

Your tool steel distributor has a good stock of Lehigh H. Or you can order a supply direct from our mill depot.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Tool Failures Can Be Caused by Magnetism

Magnetism of either stock or tools can cause mystifying failures of tools. This is particularly true of punch-and-die sets, blanking tools, and occasionally, forming tools. Difficulties traced to magnetism can develop in these ways:

1. Improper feeding or positioning of stock.
2. Improper ejection of parts or scrap.
3. Several multiples feeding in at one time on some operations.

Overloading of tools produced by any of these three conditions can cause tool failure. Besides, magnetized parts pick up steel "debris," which acts as an abrasive on cutting edges, resulting in rapid tool wear. Steel stock can be magnetized by lifting with magnets, or by passing near electrical machinery or power lines carrying heavy currents. Tools are often magnetized by being ground on equipment using magnetic chucks. They can also be magnetized by other accidental means.

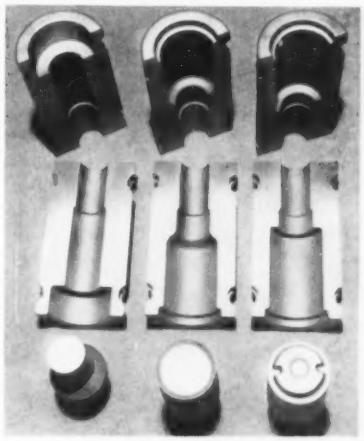
When steel parts or tools show evidence of magnetic attraction to each other, or when the edges attract steel chips or debris, steps should be taken to eliminate the magnetism. With steel stock, this can be done by tempering. But tools must be demagnetized with a demagnetizing coil, by passing them slowly in and out of the coil while it carries alternating current.

BTR HOLLOW-BAR SAVES PRODUCTION TIME

Using hardened bushings? Ring dies? Draw rings? Other ring-type applications? Then you'll find you can save time with BTR (Bethlehem Tool Room) Hollow-Bar.

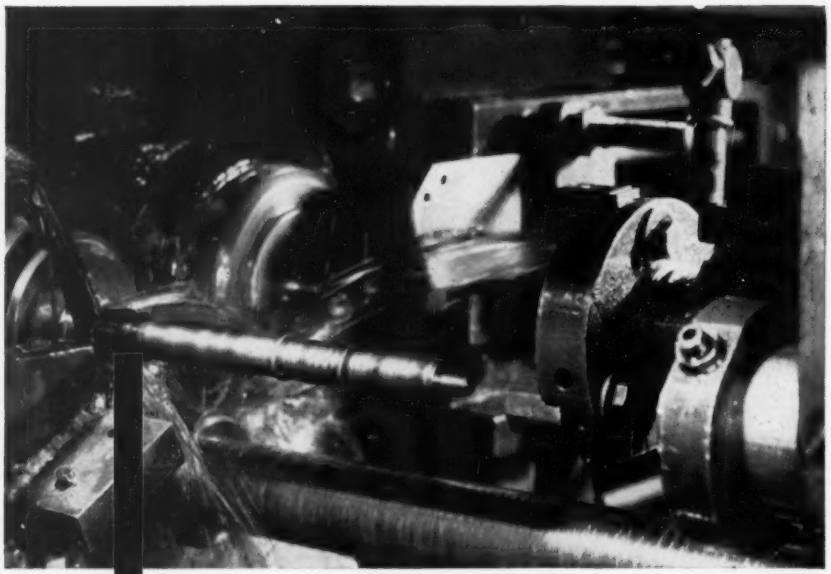
BTR Hollow-Bar is made from our popular oil-hardening tool steel by a process called high-speed trepanning, in which hammer-forged round bars are cored out in the center, and are then rough turned on the outside. The operation is much like gun drilling, except that in trepanning, the cutter produces a solid bore from the bar center.

With BTR Hollow-Bar, there's no need to wait for forged rings or discs. Nor is there any drilling, rough boring, rough facing or rough turning required. You can get full particulars about BTR Hollow-Bar from your tool steel distributor.

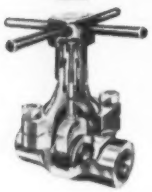


Chrome-Moly-Tungsten Lengthens Die Life

Shown here are sets of forging insert dies and (at bottom), upset punches, used in a hot-work application. The heat-treatment consists of air-quenching and double-tempering to Rockwell C 35-41 for the inserts, and Rockwell C 45-49 for the punches. Said the user, "We like the minimum size change when heat-treating CMW. We get less heat-checking on die impressions, and better resistance to washing effect. And they add up to long die life, which is just what we want."



How to make duplicate stainless steel parts economically



Make them out of ENDURO Stainless Steel Cold Drawn Bars. Then you get high production rates from your automatics, plus all the high physical and chemical properties you want from stainless steel.

Here's how one manufacturer does it: Edward Valves, Inc., East Chicago, Ind., makes a new MUDWONDER Valve used in the oil fields. It must have high resistance to corrosion and long life.

Valve stems are made of ENDURO Cold Drawn Types 410 and 416. And Edward methods engineers say they get good production for these reasons:

1. **High speeds and feeds can be used**
2. **Surface finish is excellent**
3. **Tool life is longer, down-time for re-grinding is less**

You can have these same advantages in your stainless steel parts, by specifying ENDURO Cold Drawn Bars. And Republic metallurgists will be glad to help you choose the right grades for best production on your present machines. Write to:

REPUBLIC STEEL CORPORATION
Alloy Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

REPUBLIC ENDURO FREE-MACHINING STAINLESS STEEL

REPUBLIC STEEL

Other Republic Products include Carbon and Alloy Steels — Titanium — Pipe, Sheets, Strip, Bars, Wire, Pig Iron, Bolts and Nuts, Tubing

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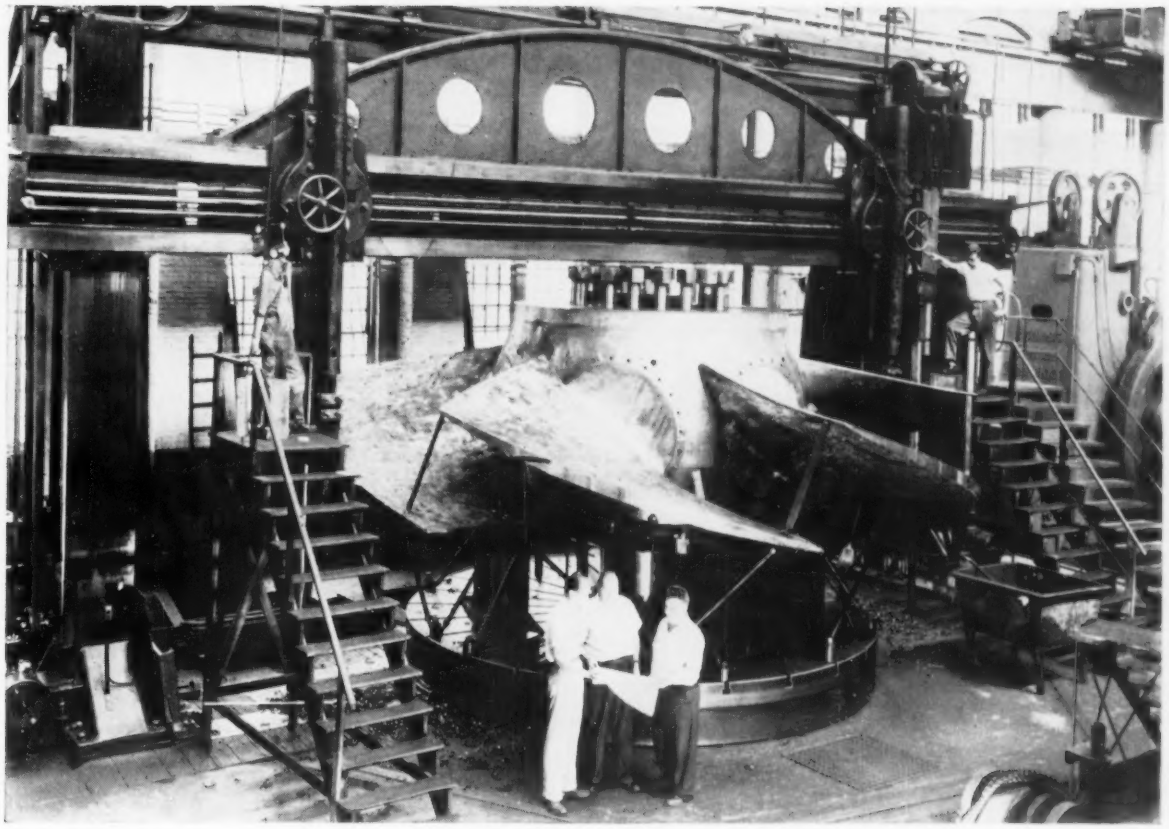


Machining 165-ton carbon steel propeller runner, Grade 370 cut heavy scale at three times former speed, with 88% less downtime. Speed—154 SFPM. Feed—1/32 inch. Depth of Cut—7/16 inch.

From on-the-job reports

PRODUCTION INCREASES UP TO 30% WITH NEW CARBOLOY® SERIES 300 STEEL-CUTTING CARBIDES

Case histories, on these pages, prove Grades 350 and 370 outperform other carbides on tough steel-cutting jobs.

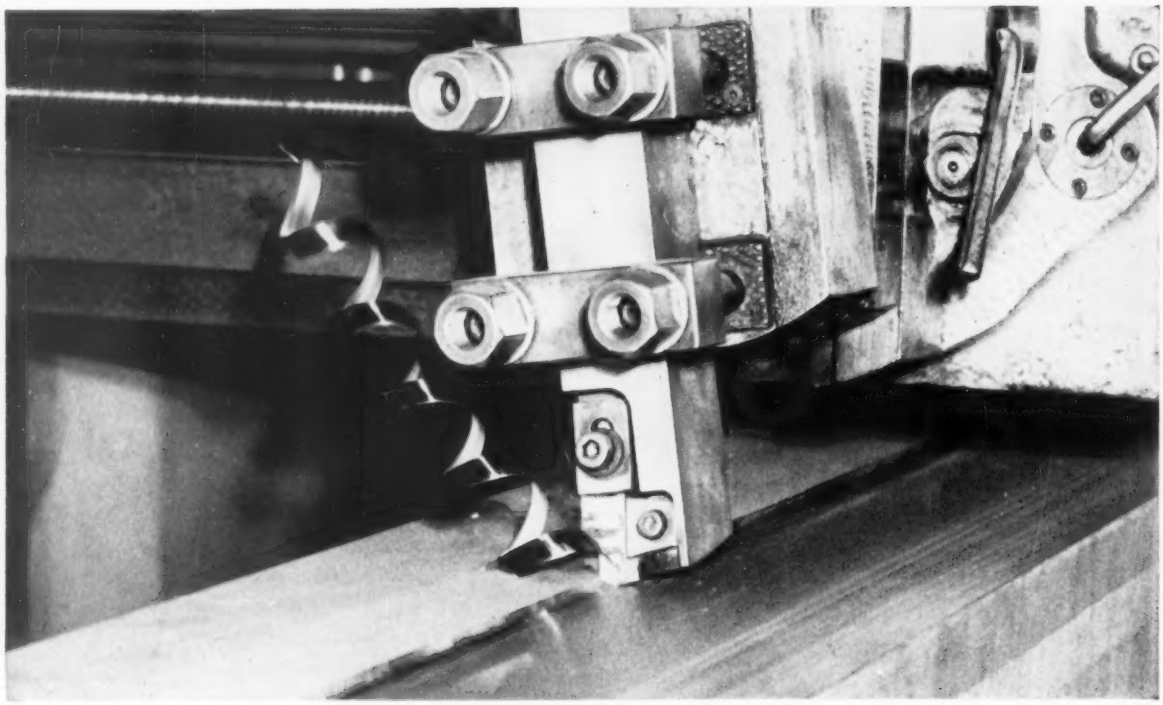
Carboloy Grades 350 and 370 are capable of cutting more cubic inches of steel per minute, with longer tool life, than any other carbides. This has been *proved* on in-the-plant applications, where these grades have boosted production as much as 30% over previous carbides used.

Grade 350 for medium-duty steel cutting, and Grade 370 for heavy-duty steel cutting, are the first of a new family of carbides manufactured by an entirely new process.

Both grades have a built-in structural rigidity that enables them to operate at temperatures as high as 1800°F without the tip deformation found in other carbides. They combine superior wear resistance and extreme toughness to a degree never before possible.

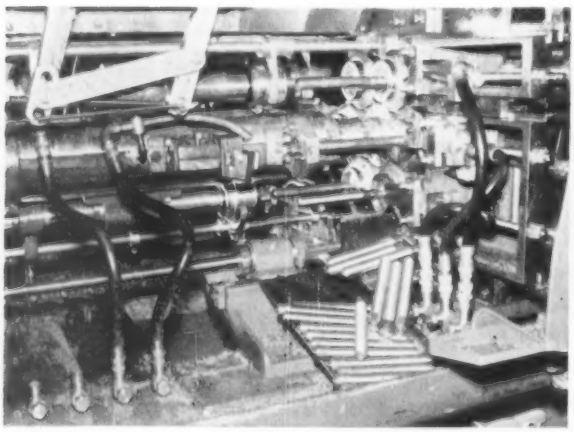
Case histories, operating data on following pages

STEEL-CUTTING CASE HISTORIES WITH



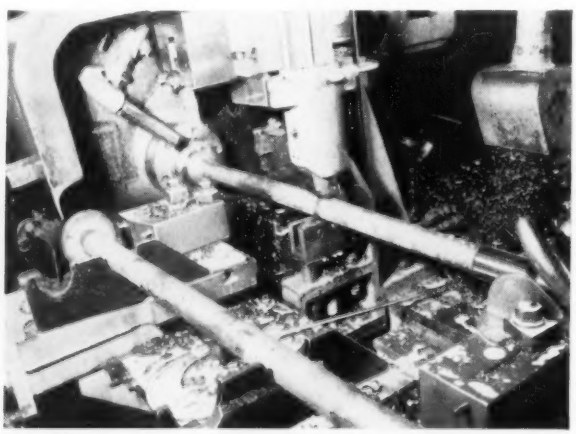
UNDERARM. A single Carboloy Grade 370 clamped-on tip planed all four sides of this normalized steel weldment at 300 surface feet per minute, without regrinding. Despite the large size (12″ x 14″ x 164″) wear on the carbide tip was only 0.010″.

SETUP: Material—1020 steel weldment, normalized. **Speed**—300 SFPM. **Feed**—0.060 inch per stroke for roughing; 0.080 inch per stroke for semifinishing. **Depth of cut**—$\frac{3}{8}$ inch for roughing; 0.030-0.040 inch for semifinishing. **Coolant**—No.



THREADED LEVELING SCREWS. Carboloy Grade 370 tools, used on 6-spindle Cone Automatic, boosted production to 944 screws per hour, compared to 140 with steel tools.

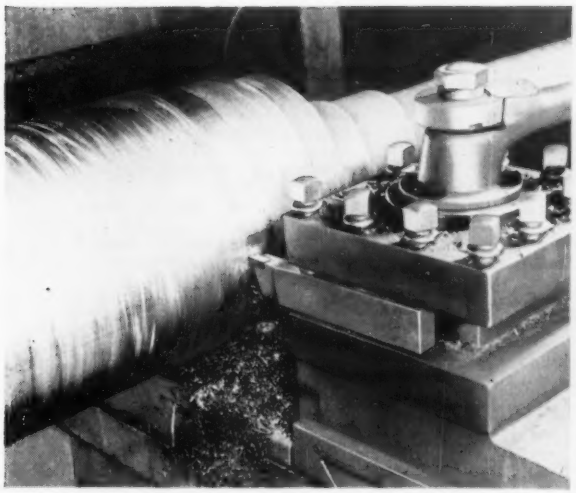
SETUP: Material—SAE B1112 1-inch diameter steel screw stock. **Speed**—1586 RPM for threading. **Feed**—0.005 inch for chamfering and cutoff. **Coolant**—Yes.



TRUCK AXLE FORGING. Turning with Grade 350 resulted in 33⅓% more pieces per tool. Chipping and flaking, encountered with previously used tools, were eliminated.

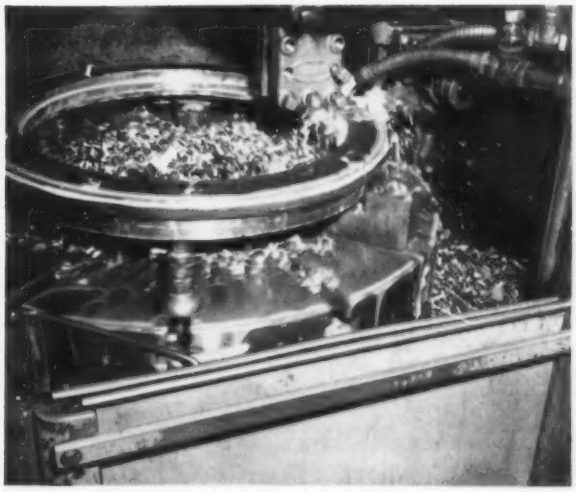
SETUP: Material—AISI 4150 steel forging. **Speed**—200 SFPM on 2-inch diameter; 400 SFPM on 4-inch diameter. **Feed**—0.014 inch. **Depth of cut**—$\frac{1}{16}$-$\frac{1}{8}$ inch. **Coolant**—Yes.

NEW CARBOLOY GRADES 350 AND 370



ELECTRIC MOTOR SHAFT. Carboloy Grade 350 increases the number of linear inches cut by 30% over other carbides used for roughing and finishing this large steel motor shaft.

SETUP: Material—AISI 1045 modified (hot-rolled) with varying heat analysis. **Speed**—300 SFPM. **Feed**—0.020 inch. **Depth of cut**—1/16 to 1/8 inch. **Coolant**—Yes.



JET ENGINE TURBINE WHEEL RIMS. With Grade 370, G. E. got 300% increase in life of tools used for turning, boring and facing cold-worked Timken steel rims. Downtime was reduced two thirds.

SETUP: Material—Cold-worked, forged Timken steel. **Speed**—160 SFPM on O.D.; 110 SFPM on I.D. **Feed**—0.010 inch. **Depth of cut**—1/2 to 7/8 inch. **Coolant**—Yes.

Full stocks now available from Authorized Carboloy Distributors

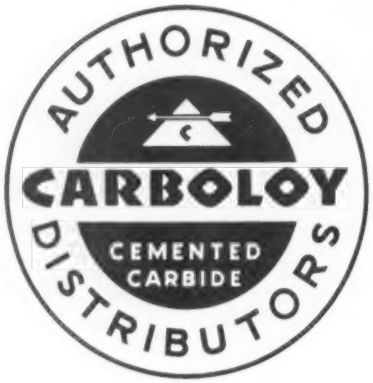
Standard Carboloy Tools are available in Grades 350 and 370. In addition, blanks and inserts of each grade are available in a wide range of styles and sizes.

Carbides for *any* machining job. Regardless of your particular machining problem, a grade of Carboloy cemented carbide is available to handle it. Over a quarter century of experience in machining ferrous and nonferrous, metallic and nonmetallic materials has been acquired by the Carboloy organization. See your Authorized Carboloy Distributor or Carboloy salesman for qualified, expert machining assistance.

Your local Authorized Carboloy Distributor is listed on the next page . . .

AUTHORIZED CARBOLOY DISTRIBUTORS

NATIONWIDE AVAILABILITY AND SERVICE



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DEPARTMENT OF GENERAL ELECTRIC COMPANY
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check with the standard

... and with high speed steels

the standard is REX

It's easy to check on Junior's vision these days with *standard* eye charts. And for half a century there's been a *standard* in tool steels, too — Crucible REX® High Speed Steel.

Try REX High Speed Steel in your own shop as thousands all over the world have done. Use it under the toughest conditions . . . compare its performance with all other high speed steels. You'll find that *absolutely nothing beats REX.*

That's because REX High Speed Steels are unsurpassed in structure, finish, carbide distribution, response to heat treatment and general uniformity. So, on your next purchase of high speed steel, specify REX — made only by Crucible.

CRUCIBLE first name in special purpose steels

54 years of *Fine* steelmaking **TOOL STEELS**

CRUCIBLE STEEL COMPANY OF AMERICA • TOOL STEEL SALES • SYRACUSE, N. Y.

Canadian Distributor — Railway & Power Engineering Corp., Ltd.

Conquers Heat, Erosion and Corrosion. Stainless steels containing nickel lengthen life expectancy of various components used in severe service. For instance, Diesel engine turbocharger rotors. Some rotors operate at from 12,500 to 21,000 r.p.m., and at temperatures upward of 1000°F. The rotor comprises a slotted disc of chromium-nickel stainless steel, with inserted blades of the same material . . . to take the brunt of attack in converting heat into mechanical power. Type "19-9" stainless, containing molybdenum and tungsten additions, is used to make sure of high tensile strength and low creep at the high temperatures encountered. And a somewhat similar austenitic chromium-nickel stainless steel . . . 18-8-S-Mo . . . is used for turbine nozzle blades.

STAINLESS PROVIDES THE ANSWERS . . .

Thousands of designers and engineers have found austenitic chromium-nickel stainless steels to be the key to new high standards of product performance and minimum operating costs. You, too, may find that a stainless steel containing nickel will help solve *your* metal problem.

1. At Elevated Temperatures

Stainless steels of this type possess the two essential qualities for successful use at elevated temperatures. By virtue of the chromium content, and assisted by the nickel content, they have outstanding resistance to scaling and oxidation. The nickel content also results in high creep strength and stress-to-rupture properties. Combined, these properties permit use of chromium-nickel stainless even in thin sections required for lightweight design.

2. At Sub-Zero Temperatures

Experience has shown that unalloyed steels become embrittled rapidly as temperature is lowered below normal. Nickel is by far the best alloying element to prevent brittleness. At sub-zero temperatures, chromium-nickel stainless steels provide unsurpassed impact values. These steels retain such a high level of toughness that they are known to be useful at temperatures as low as −400° F. and possibly even lower.

3. Under Corrosive Conditions

Selection of exactly the right alloy for your specific needs may be made from some thirty alloy steels qualified to carry the family name "Stainless." By virtue of their strength and resistance to attack by chemicals and atmospheres over a wide range of concentrations and temperatures, these austenitic chromium-nickel steels assure not only longer life of the equipment and purity of product, but also permit decrease of bulk and deadweight without sacrificing safety.

4. Where Erosion Is A Problem

Chromium-nickel stainless offers the utmost in resistance to erosion and cavitation. By cold working, it is possible to increase the tensile strength to as much as 300,000 psi. When subjected to erosion, the erosive media work hardens the surface and, correspondingly, curbs the attack. This resistance to erosion combined with corrosion resistance results in prolonged life for equipment made from the chromium-nickel stainless steels.

5. Use *Stainless* To Meet Complex Requirements

Utilize the unique combination of properties provided by chromium-nickel stainless steels when designing new products or improving old ones. You can draw, spin, forge, weld, solder, punch, shear or bend chromium-nickel stainless steels. Leading steel companies produce these austenitic alloys in all commercial forms. A list of sources of supply will be furnished on request.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

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HOW TO MAKE RING-SHAPED TOOL STEEL PARTS FASTER AND EASIER

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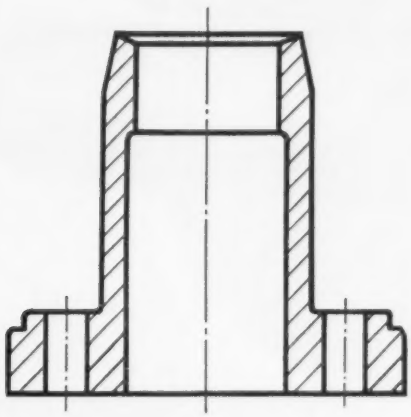
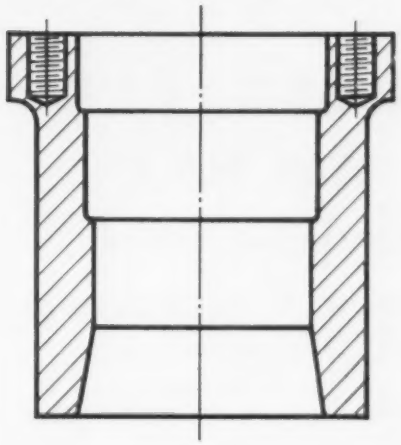
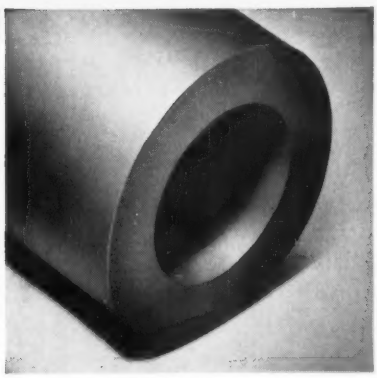


BLANKING AND FORMING DIE





Graph-Mo Hollow-Bar comes in sizes from 4 to 16 inches O. D. with various wall thicknesses. Immediate delivery on many sizes from warehouses of the distributors, A. Milne Co. and Peninsular Steel Company.

New GRAPH-MO HOLLOW-BAR® eliminates drilling— and machines 30% faster

YOU can eliminate the time-consuming drilling operation when you make ring-shaped tool steel parts from Graph-Mo Hollow-Bar®. The hole comes ready-made. First step is finish boring. There's less scrap, and you use less steel.

On top of that, the rest of the machining's faster—30% faster, compared to other tool steels. That's because Graph-Mo has free graphite in its structure. It means less tendency to pick up, scuff and gall, too.

That same graphite plus diamond-hard carbides give Graph-Mo amazing wear resistance. Users have written us that Graph-Mo outwears other tool steels, on the average, three to one!

Graph-Mo responds uniformly to heat treatment. And no other tool steel is as stable. Proof: after 12 years, a typical Graph-Mo steel master plug gage changed less than 10 millionths of an inch in dimension!

More facts about Graph-Mo Hollow-Bar? Write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

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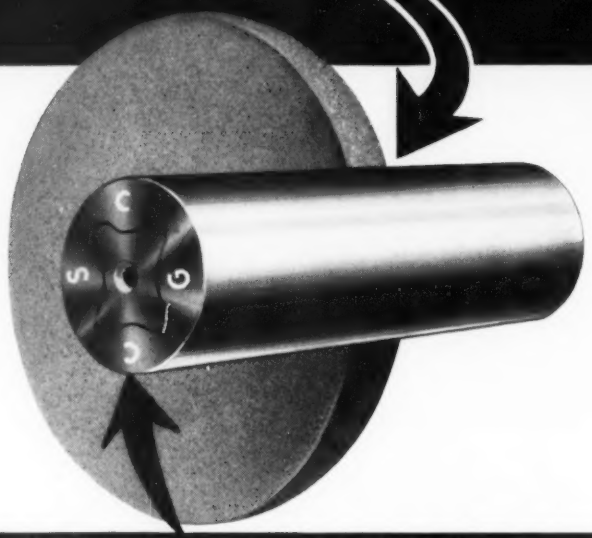
An exclusive GRINDING PROCESS...

makes

CUMBERLAND STEEL BARS

concentric, straight,

smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000≠ Min
Potomac Brand—AISI C-1040, Elastic Limit 45,000≠ Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000≠ Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845 INCORPORATED 1892

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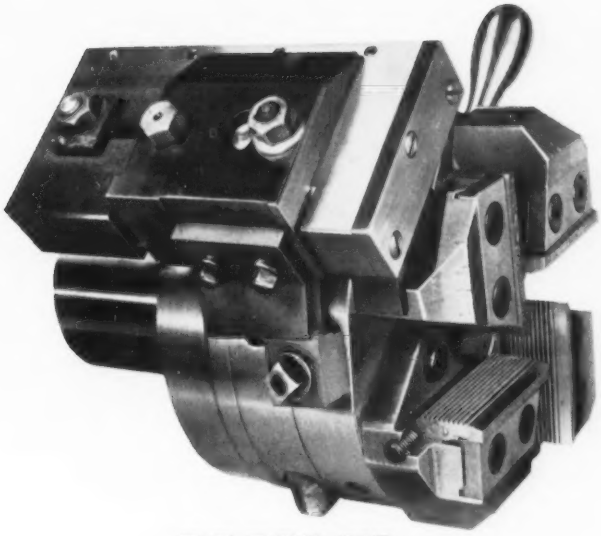
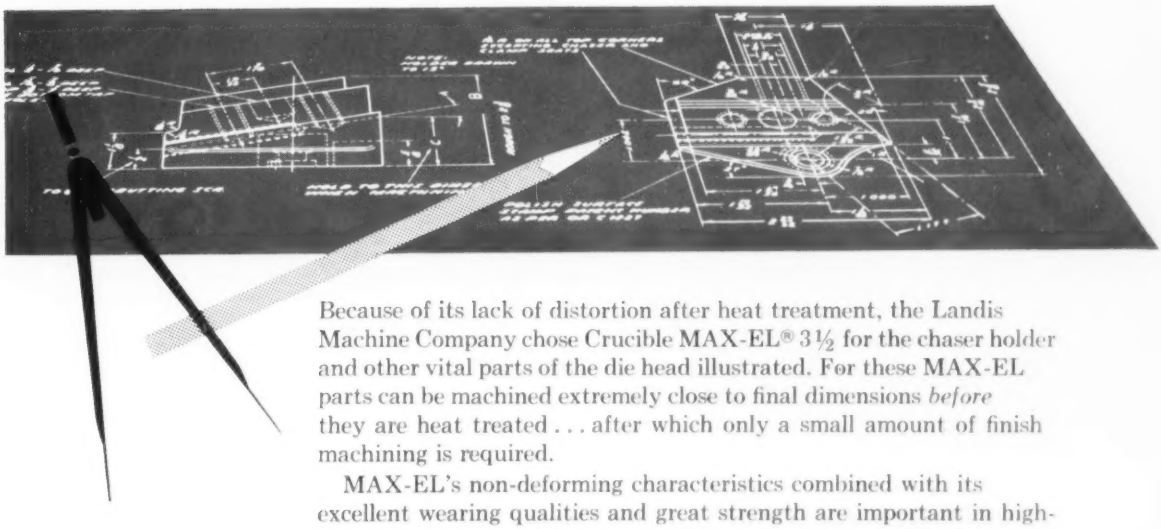


Non-deforming **MAX-EL** alloy steel parts require minimum finish machining



Because of its lack of distortion after heat treatment, the Landis Machine Company chose Crucible MAX-EL® 3½ for the chaser holder and other vital parts of the die head illustrated. For these MAX-EL parts can be machined extremely close to final dimensions *before* they are heat treated . . . after which only a small amount of finish machining is required.

MAX-EL's non-deforming characteristics combined with its excellent wearing qualities and great strength are important in high-speed turret lathe die heads . . . and in many other applications.

Your shop will benefit, too, from the ease of machining, freedom from distortion, superior quality and longer tool life you get with MAX-EL. To start taking advantage of MAX-EL *now, call Crucible.*

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **ALLOY STEELS**

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You save money when your steel parts can be made from special sections

The pinion gear window regulators shown above were made from Republic Cold Drawn Special Sections. They were made at less cost because much of the machining was eliminated.

You can save, too, because Republic Cold Drawn Special Sections are already formed to the predominating cross section of your part.

Your parts also benefit from the increased physicals produced by cold drawing. It gives them higher strength, greater hardness and a bright smooth finish that rarely requires further finishing.

Large tonnage requirements are not necessary, but they do result in greater economies. We can produce cold drawn sections in large or small quantities to meet your requirements. Sections can be produced in a wide variety of analyses. Possibilities for variation in contour are almost limitless.

A Republic representative will be happy to call at your plant. Or send us samples or blueprints of your parts. We will tell you promptly and impartially whether the nature of your parts would make the use of Republic Union Drawn Special Sections efficient and economical.

REPUBLIC STEEL CORPORATION

Union Drawn Steel Division • Massillon, Ohio

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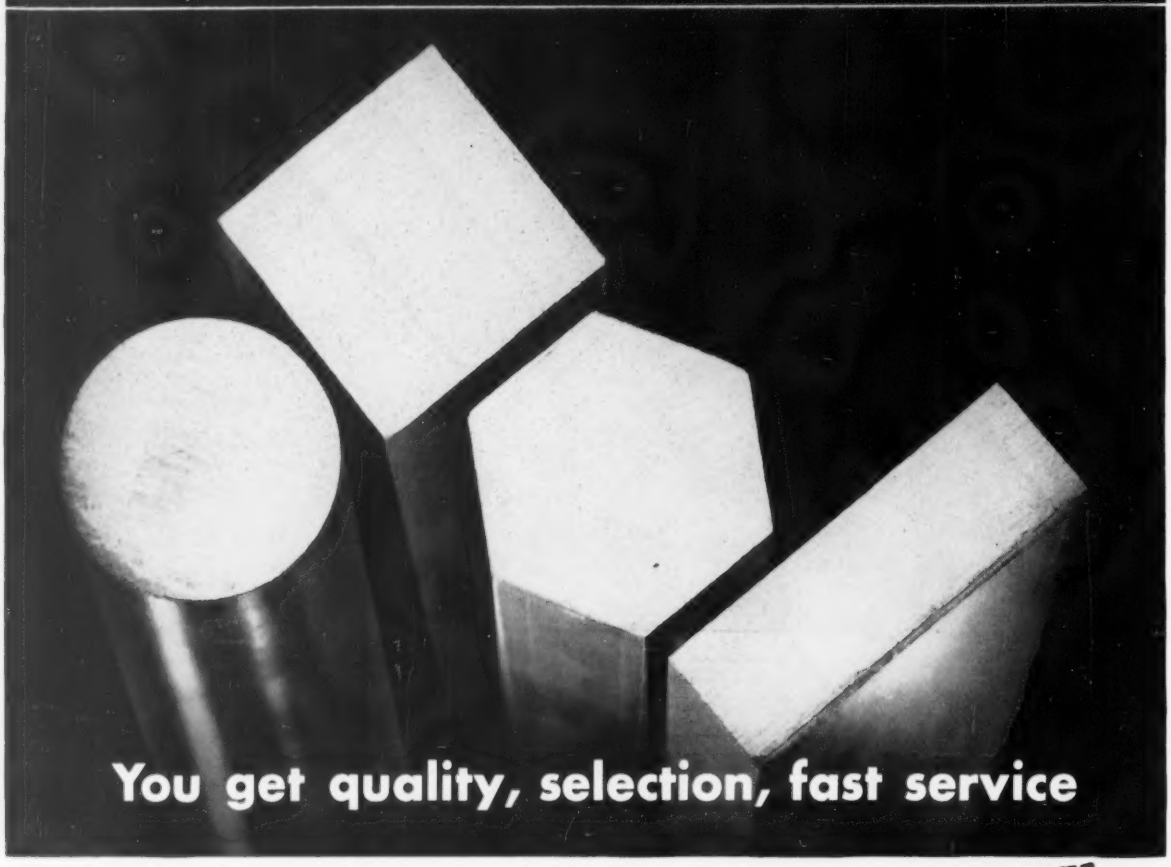
These sample shapes are only a few of thousands produced by Republic. They may give you an idea on how you can use Republic Cold Drawn Special Sections for your product.

REPUBLIC *Union*® COLD DRAWN STEELS

REPUBLIC STEEL

WHY IT PAYS TO BUY COLD FINISHED BARS FROM US



You get quality, selection, fast service

You will save money buying your cold finished bars from U.S. Steel Supply. We carry complete stocks of all the shapes and sizes that are in common demand. All are manufactured from the world's leading quality steel—United States Steel. And we will work closely with you to select exactly the right quality for your requirements—and the right quality is *not* always the most expensive.

You needn't tie up money and space in large inventories of cold finished bars . . . we can quickly supply whatever you need. Call us for: cold finished rounds, squares, hexagons, flats and precision shafting in all grades; cold finished screw stock. Bessemer rounds, "MX" high speed screw stock.

TRIPLE SECURITY

What you want
When you want it
At the **right price**

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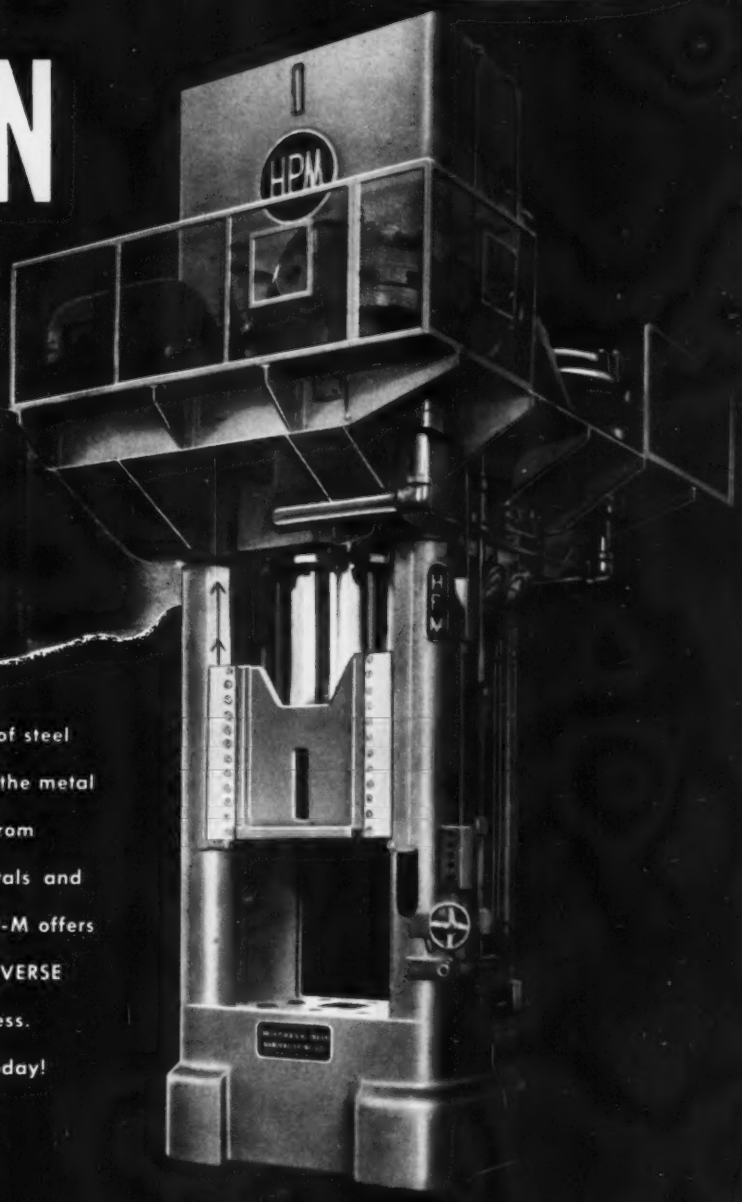
COLD EXTRUSION

Calls for H-P-Ms

H-P-M *FASTRAVERSE* Single Action Press with Hydraulic Ejector



Cold Extrusion . . . the cold shaping of steel by compression . . . opens new horizons for the metal working industry. It means more parts from less material, utilizes lower-cost metals and saves machining and production time. H-P-M offers a complete line of all-hydraulic, FASTRAVERSE presses for the cold extrusion process. Talk to your H-P-M representative today!

HPM

THE HYDRAULIC PRESS MFG. COMPANY
MOUNT GILEAD
OHIO, U. S. A.

A FEW OF THE HUNDREDS OF USERS OF H-P-M ALL-HYDRAULIC FASTRAVERSE PRESSES

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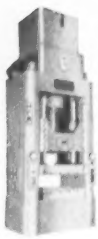
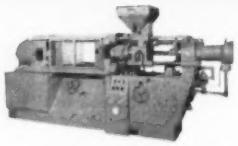
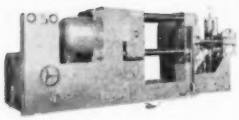
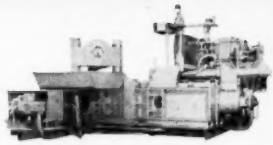
ALL-HYDRAULIC *FASTRAVERSE* PRESSES FOR EVERY PRESSURE PROCESSING NEED!


Metal Working

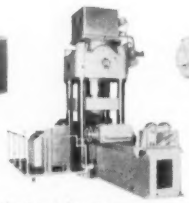
Blocking & Briquetting

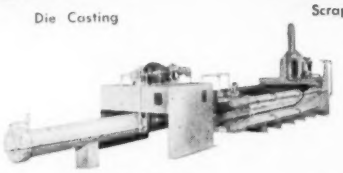

Injection Molding

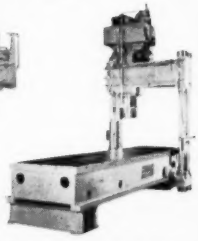

Die Casting

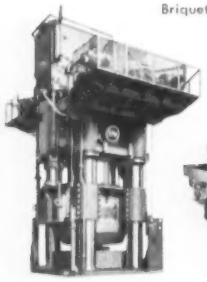

Scrap Baling

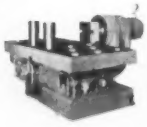
Compression & Transfer Molding


Shaft Straightening


Rayon Steeping


Two-way Straightening

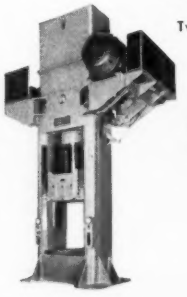

Rubber Pad Forming

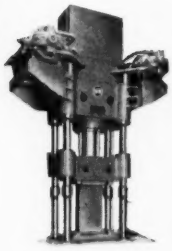

Bending

Reinforced Plastics Molding

Cartridge Case

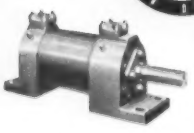
Cold Extrusion


Shell Forging


Forging

HPM-DIAFORM (Rubber Diaphragm Forming)

A *NEW* COMPLETE LINE OF HYDRAULIC COMPONENTS!


CYLINDERS
150 P.S.I. Air and 300 to 3000 P.S.I. Oil Hydraulic

VALVES
Directional and Functional, complete range to 3000 P.S.I.

PUMPS & MOTORS
Fixed and Variable Displacement to 3000 P.S.I.

POWER UNITS
Complete power packages for every application.

ACCESSORIES
Items to complete that hydraulic circuit.

WORLD-WIDE SALES ENGINEERING COVERAGE

H-P-M DOMESTIC OFFICES

CHICAGO 45, ILLINOIS
DETROIT 2, MICHIGAN
MOUNT GILEAD, OHIO
TEANECK, N. J.
PITTSBURGH 22, PA.

DOMESTIC REPRESENTATIVES

ATLANTA, GEORGIA
Chandler Machinery Co
BIRMINGHAM 3, ALABAMA
Quinn, McKerall & Quinn
CAMBRIDGE 42, MASS.
Austin Hastings Co., Inc.
DALLAS, TEXAS
Tri-State Machinery Co.
DENVER, COLORADO
The Mine & Smelter Supply Co.
HOUSTON 2, TEXAS
The H. L. Thompson Co.
KANSAS CITY, MISSOURI
Blackman & Nuetzel Mach. Co.
LOS ANGELES 11, CALIF.
Machinery Sales Co.
NEW ORLEANS, LOUISIANA
Frederic & Baker
OMAHA 2, NEBRASKA
Fuchs Machinery & Supply Co.
PORTLAND, OREGON
Hallidie Machinery Co., Inc.
RICHMOND 2, VIRGINIA
Smith-Courtney Company
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Blackman & Nuetzel Mach. Co.
SALT LAKE CITY, UTAH
The Mine & Smelter Supply Co.
SAN FRANCISCO 3, CALIF.
B-H-S Machinery Sales Co.
SEATTLE 4, WASHINGTON
Hallidie Machinery Co., Inc.
SHREVEPORT, LOUISIANA
Frederic & Baker
TULSA, OKLAHOMA
Blackman & Nuetzel Mach. Co.
WASHINGTON, D. C.
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CANADIAN REPRESENTATIVE

TORONTO, ONTARIO
F. F. Barber Machinery Div.
Massey-Harris-Ferguson, Ltd.

EXPORT DEPARTMENT

MOUNT GILEAD, OHIO
The Hydraulic Press Mfg. Co.
CABLE ADDRESS: "HYDRAULIC"

THE HYDRAULIC PRESS MFG. CO. / MOUNT GILEAD, OHIO, U. S. A.

If "EP" lubrication poses a problem for you . . . here's help!

Here's new technical letter on Stanogear Compounds—send for free copy today!

If you've been having lubricating problems with overloaded or shock-loaded gears on your equipment, New STANOGEAR Compounds—with 7 better EP lubricating features—are made just for you. New and improved STANOGEAR Compounds are recommended for industrial gear applications where the operating conditions of the gear unit demand an extreme pressure lubricant . . . their superiority has been proved in test after test and *on the job!*

New STANOGEAR Compounds work seven ways better to solve your EP problems: **1.** higher load-carrying capacity **2.** superior retention of load-carrying capacity **3.** freedom from objectionable deposits **4.** excellent storage stability **5.** good water separation **6.** anti-foaming **7.** increased versatility

Now Standard Oil has prepared a special technical letter to give the complete story on STANOGEAR Compounds and EP lubrication. For your copy of this factual, informative bulletin, call your nearest Standard Oil office. The Standard Oil lubrication specialist there can answer your questions and send you a copy of the EP story, without obligation. Or write to: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY

STANDARD *(Indiana)*

13" TOOLROOM LATHE

SOUTH BEND 13" LATHES

Illustrated—13" x 5' bed Toolroom Lathe, less motor and controls, f.o.b. factory. $1972

for accurate, low-cost machining

South Bend 13" Lathes are popular where there is a variety of precision parts to be machined. Costs drop as their accuracy and efficiency keep production flowing fast even on the "headache" jobs. Operators prefer them for their simplicity and practically effortless handling. Also, set-ups and change-overs are made so quickly and easily that down-time is held to a minimum.

Now is the time to find out how these quality-built lathes can also bring you better machining at lower costs. Let your near-by South Bend distributor show you how they can ease your production, toolroom and maintenance machining problems. Or, mail coupon for literature on the 13" Toolroom and Quick Change Gear models.

SPECIFICATIONS

Swing—13⅛" over bed and saddle wings, 8" over saddle cross slide.

Distance Between Centers—28¼", 40¼" and 52¼".

Collet Capacity—1" maximum (collets interchangeable with 10"–1", 14½", 16" and 16–24" South Bend lathes).

Spindle Bore—1⅜".

Spindle Speeds—Eight; 40, 60, 90, 135, 270, 418, 628 and 940 r.p.m. approx.

Longitudinal Feeds—48 R.H. or L.H., .0015" to .0841".

Cross Feeds—48, .0006" to .0315".

Thread Cutting—48 R.H. or L.H. pitches, 4 to 224 per inch.

Compared with our costs
OUR PRICES ARE LOWER
than they were back in 1941

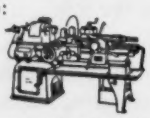
Prices are closely tied to costs. Costs are still rising. Buy now before increased costs necessitate higher prices.

PLEASE SEND INFORMATION CHECKED:

☐ 9" and 10" BENCH LATHES

☐ 10" to 16-24" FLOOR LATHES

☐ DRILL PRESSES



☐ ½" & 1" Collet TURRET LATHES

☐ TOOL GRINDERS

☐ 7" BENCH SHAPERS

Name_____ Street_____

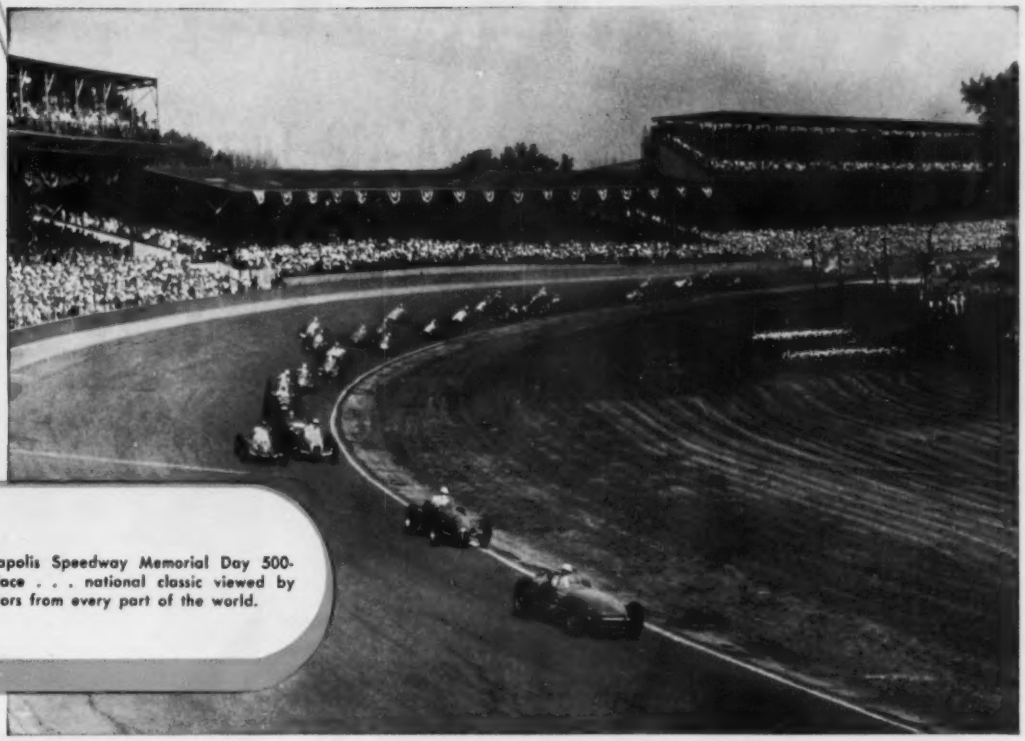
City_____ State_____

Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana

For more information on products advertised, use Inquiry Card, page 245

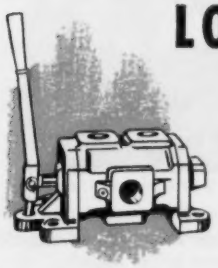
LOGAN . . . a national participant in major fluid power advancements

SINCE 1916



Indianapolis Speedway Memorial Day 500-Mile Race . . . national classic viewed by spectators from every part of the world.

LOGAN HYDRAULIC CONTROL VALVES

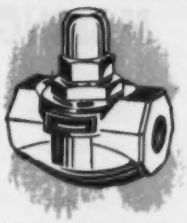


Illustrated, Model 4015—4-way, 2-position valve for directing pressure alternately to ends of double-acting hydraulic cylinder.

A broad range of types and sizes to most effectively meet any requirement—Design Engineers, Machine Operators, Maintenance Men appreciate these Logan advantages

- LONG-LIFE CONSTRUCTION
- EASY TO SERVICE
- INFREQUENT MAINTENANCE
- EASE OF INSTALLATION
- EFFORTLESS OPERATION
- UNRESTRICTED PORTING

Let Logan Engineers help you design your Air and Hydraulic Circuits



Illustrated, Model 8015 adjustable speed control valve. Install between operating valve and one end of cylinder to meter flow of oil in one direction with free flow on return.

LOGAN MANUFACTURES 6,975 STANDARD CATALOGED ITEMS

FREE CATALOG ON REQUEST

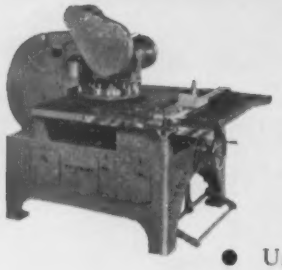
AIR CONTROL VALVES, Cat. 100-4 • AIR CHUCKS, Cat. 70-1 • AIR CYLINDERS, Cat. 100-1 • AIR-DRAULIC CYLINDERS, Cat. 100-3
AIR and HYDRAULIC PRESSES, Cat. 51 • COLLET GRIP TUBE FITTINGS, Cat. 200-5 • HYDRAULIC CONTROL VALVES, Cat. 200-4
HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 • HYDRAULIC POWER UNITS, Cat. 200-1 • SURE-FLOW COOLANT PUMPS, Cat. 62

SAVES TIME — Logan — AIR AND HYDRAULIC EQUIPMENT — EFFORT • MOTION

LOGANSPORT MACHINE CO., INC., 810 CENTER AVE., LOGANSPORT, IND.

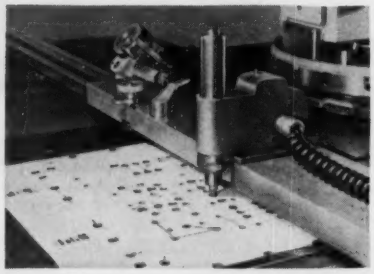
SAVE 90% with a WIEDEMANN

The RA-41P Turret Punch Press *Pays for itself in 2 YEARS or LESS*



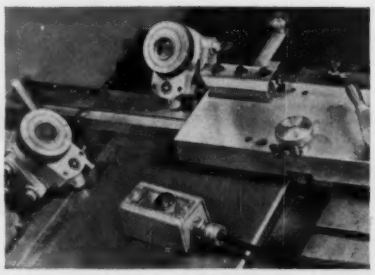
Save 90% on PIERCING

- Unmatched for high speed, low cost duplication of intricate hole patterns in flat sheet metal—low to medium production quantities.
- 18 or 20 punches and dies in turrets ready for use.
- Hole locations are made to a color-coded template—50 or more holes per minute.



Save 90% on TEMPLATE MAKING

- Press can be supplied with optical dimensioning instruments for template making.
- These templates are used with the RA-41P as well as for other applications. Drill jigs, prototypes, etc. are also produced to a tolerance of ±.002″ in 10% of the time usually required.



Wiedemann ships each press tooled—ready to produce your parts as soon as the machine is leveled and connected to your power line.

Wiedemann engineers will be pleased to study your drawings and show how these savings can be yours.

Write for a copy of Bulletin 241

WIEDEMANN MACHINE COMPANY

4205 Wissahickon Avenue, Philadelphia 32, Pa.

For more information on products advertised, use Inquiry Card, page 245

...consult

Yes, we have the most modern machines and the know-how for making the "whole family" of Bevel Gears:

Coniflex or Straight Tooth Bevels; Miter Gears; Curved Tooth Spiral Bevels; Hypoids; Zerols . . . up to ninety-six inches diameter, of any material, in any quantity.

Each gear belonging to the *Spiral Bevel* "family" has certain definite characteristics which should be taken into consideration in relation to the particular power transmission job to be met . . . and this is just where *Phillie Gear's Engineering advice and recommendations* have proven invaluable to many firms over the years.

Regardless of the simplicity or complexity of your problems involving the use of gears, it will pay you to do as thousands of others have done . . . *Consult "Phillie Gear,"* and be assured of complete satisfaction.

Spur	Splines
Helical	Coniflex Bevel
Spur Internal	Spiral Bevel
Helical Internal	Zerol
Rack	Hypoid
Herringbone	Intermittent
Worm	Sprockets
Non-Metallic	

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears & Speed Reducers

LimiTorque Valve Controls

A SURVEY of importance to industrial managements

Leadership

in any sphere of industry is usually well defined—by product, service, reputation. For a recent widespread survey, an outside unbiased research organization selected *files* . . . contacted the purchasing heads of 37 types of potential file-using industries . . . and came up with these interesting facts.

"What make or brand of files do you prefer?"

"NICHOLSON" was voted first choice in 79% of the replies. Nearest to this were competitive brands "A," "B," "C" and "D" with 26%, 15%, 7% and 5% respectively. Eleven remaining brands received scattered preferences totaling 10%. (Some 200 replies contained two or more "first" choices.)

"What is of first importance in your file-brand preference?"

"Product reputation," said 295 respondents. "Service," said 282. Only 28 said "Price."

"From what sources do you buy your files?"

"From Industrial Distributors," said 619 out of 695—about 89%. And where Nicholson or Black Diamond brand is concerned the rate would be 100%—for that is the only channel through which Nicholson sells to the widespread industrial market.

• • •

The fact that these findings bear close similarities to other independent surveys made in the past leaves no doubt where Nicholson brands stand.

And what are the fundamentals to this emphatic Nicholson leadership? Product QUALITY, PERFORMANCE, UNIFORMITY and VALUE of the highest order. Product VARIETY that truly covers *A file for every purpose.* And, through your Industrial Distributor, the most helpful technical and supply SERVICE ever organized by any file manufacturer *anywhere.*

NICHOLSON U. S. A.

NICHOLSON FILE COMPANY, PROVIDENCE 1, R. I.

(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)

BLACK DIAMOND MADE IN U.S.A.

NICHOLSON FILES *FOR EVERY PURPOSE*

For more information on products advertised, use Inquiry Card, page 245

Whatever kind of gears you make...
Whatever way you make them

National Tool Co.

can supply the right type cutting tool because we make *all* types

National Tool Co., with 50 years experience in the manufacture of special cutting tools, makes *all* varieties of gear cutting tools for *all* types of spur, helical and worm gears—as well as for sprockets and splines. Whatever your gear requirements—large or small—National engineers can help you decide the most efficient method of producing them. Many gear manufacturers have found it profitable to look to National Tool Co. for all their gear cutting tool requirements.

Gear Shaving Cutters

Hobs

Rack Type Gear Shaper Cutters

Gear Shaper Cutters

Involute Gear Cutters

Master Gears

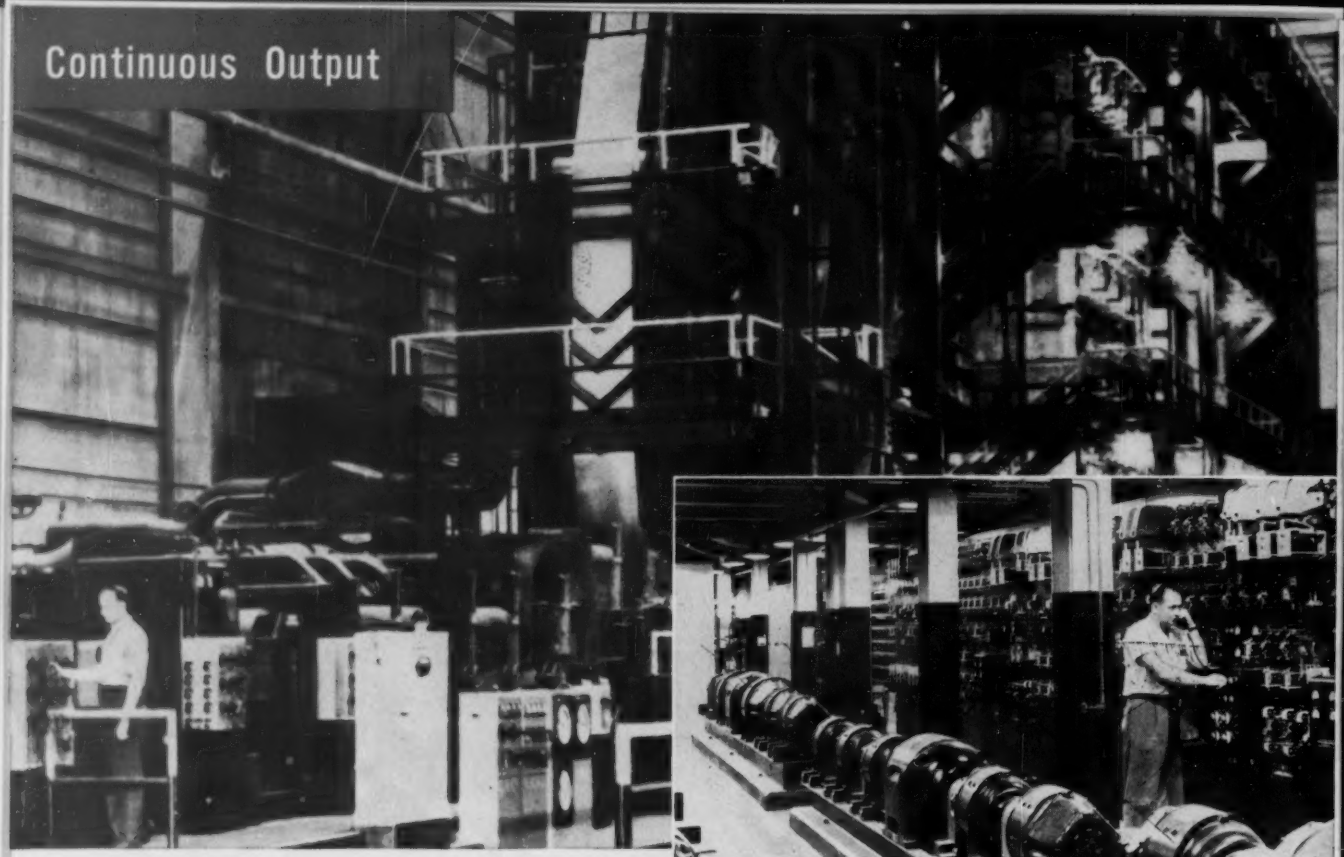
Herringbone Gear Cutters

NATIONAL Tools CLEVELAND

National
TOOL CO.
Cleveland 2, Ohio

Representatives in major industrial centers

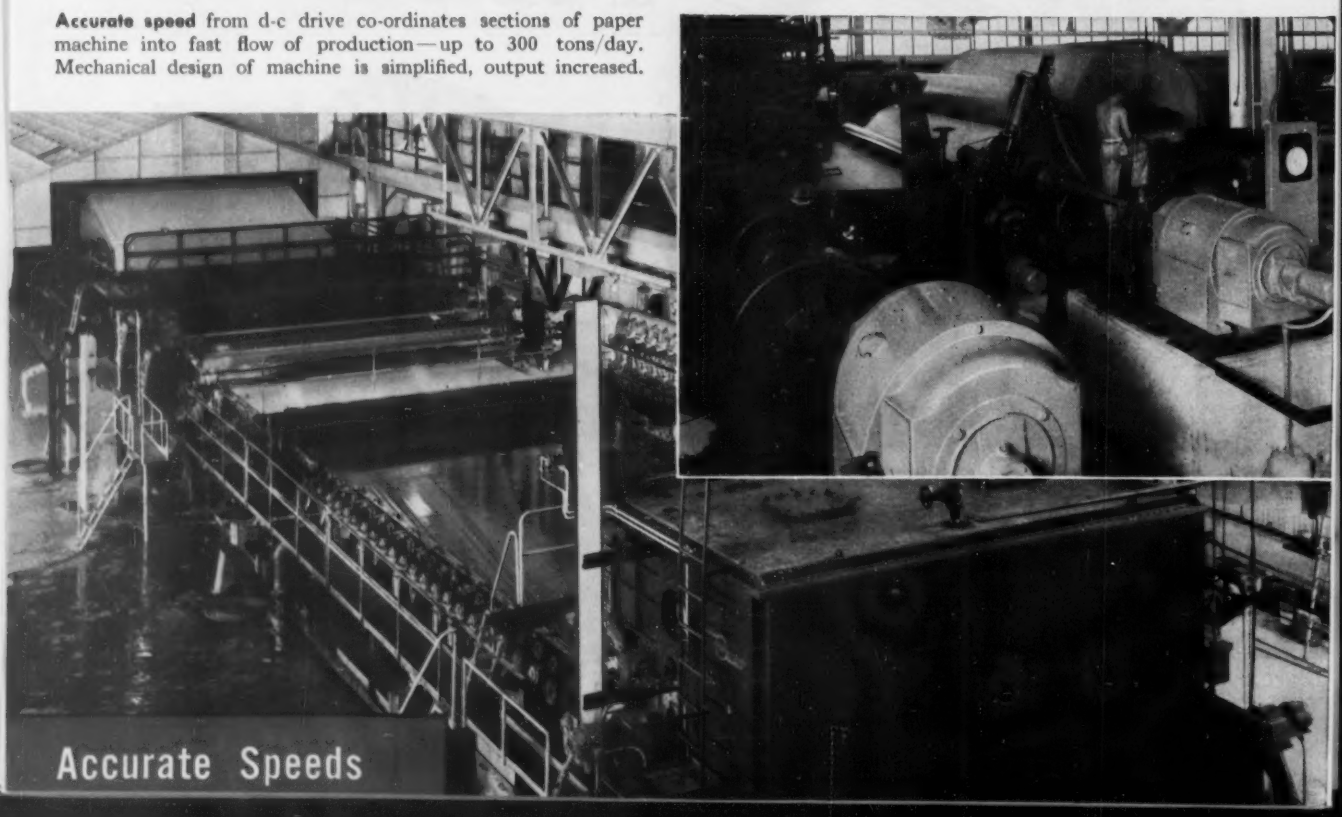
Continuous Output



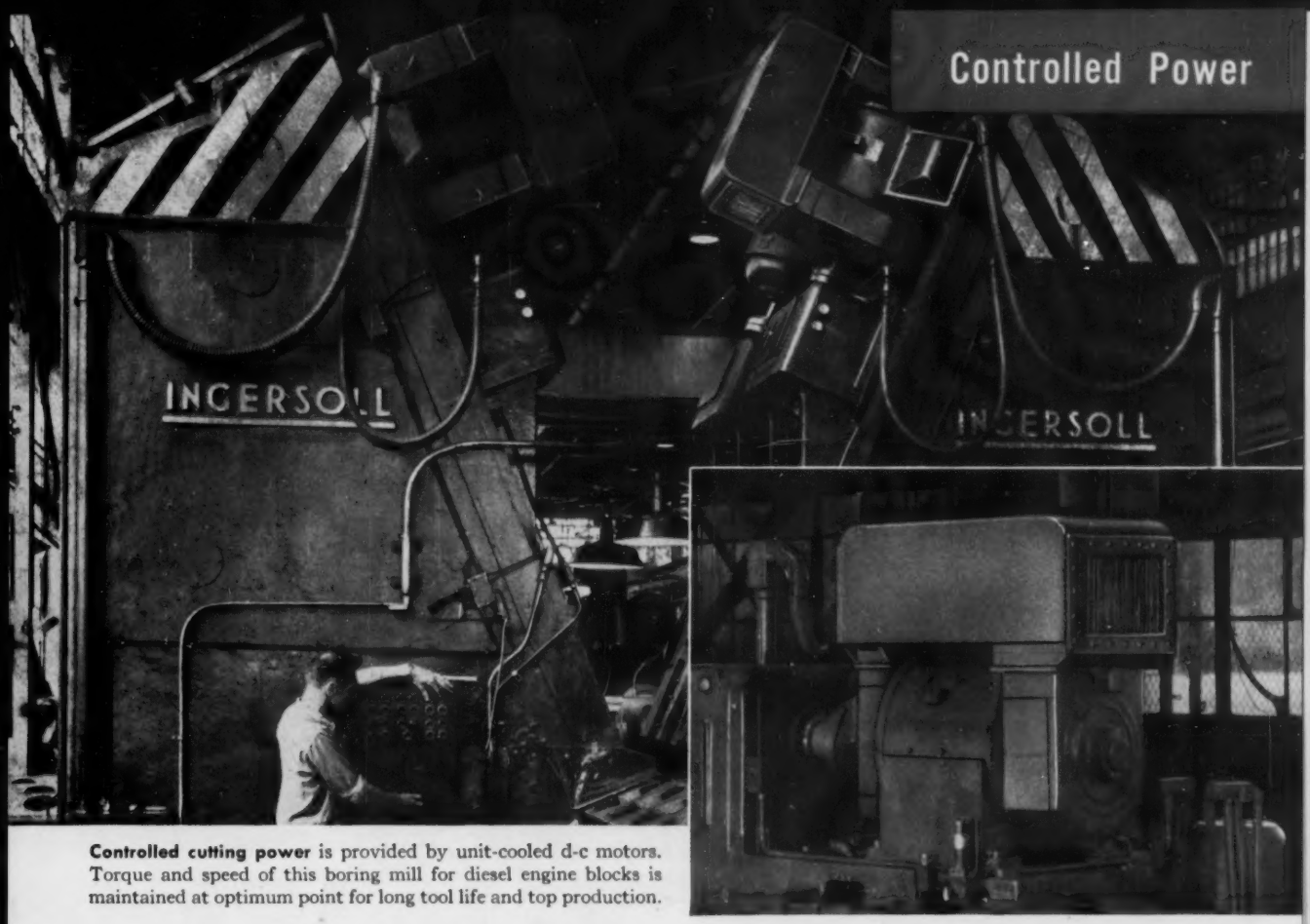
Co-ordinated G-E drive and furnace help produce up to 30 tons/hour of annealed strip. Adjustable voltage d-c generators co-ordinated by modern control provide smooth, fast, precise operation.

How General Electric d-c drives

Accurate speed from d-c drive co-ordinates sections of paper machine into fast flow of production—up to 300 tons/day. Mechanical design of machine is simplified, output increased.



Accurate Speeds



Controlled cutting power is provided by unit-cooled d-c motors. Torque and speed of this boring mill for diesel engine blocks is maintained at optimum point for long tool life and top production.

help make production automatic

DC MOTORS STEP UP PRODUCTION THROUGHOUT INDUSTRY

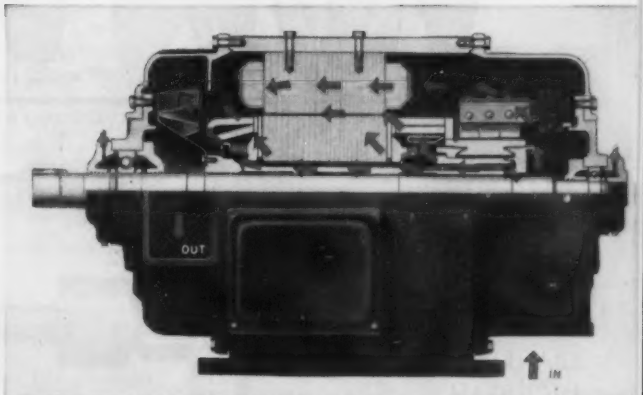
DC drives give you precise control of torque, speed, and power —essential in automatic production. The degree of precision depends on the steady performance and continuity of service of d-c motors and generators. In applications requiring close speed regulation, quick reversing, severe peak loads, G.E.'s complete line of Type CD-1000 motors is:

ECONOMICAL—the right speed at all times means less waste, fast production and low manufacturing costs per unit.

EASY TO MAINTAIN—built for long life with occasional inspection only—easily removable inspection covers. All connections are enclosed, yet easily accessible.

VERSATILE—Today's industry is more automatic than ever before. Regardless of application—in steel, paper, machine tool, and many other industries—G-E direct-current motors have gained the reputation of delivering continuous output at lower costs and accurate speeds for peak production.

FOR MORE INFORMATION, contact your nearest Apparatus Sales representative, or write for bulletin GEA-5497, general-purpose d-c motors, or GEA-6091A, totally-enclosed unit-cooled d-c motors. Section 810–4, General Electric Co., Schenectady, N. Y.

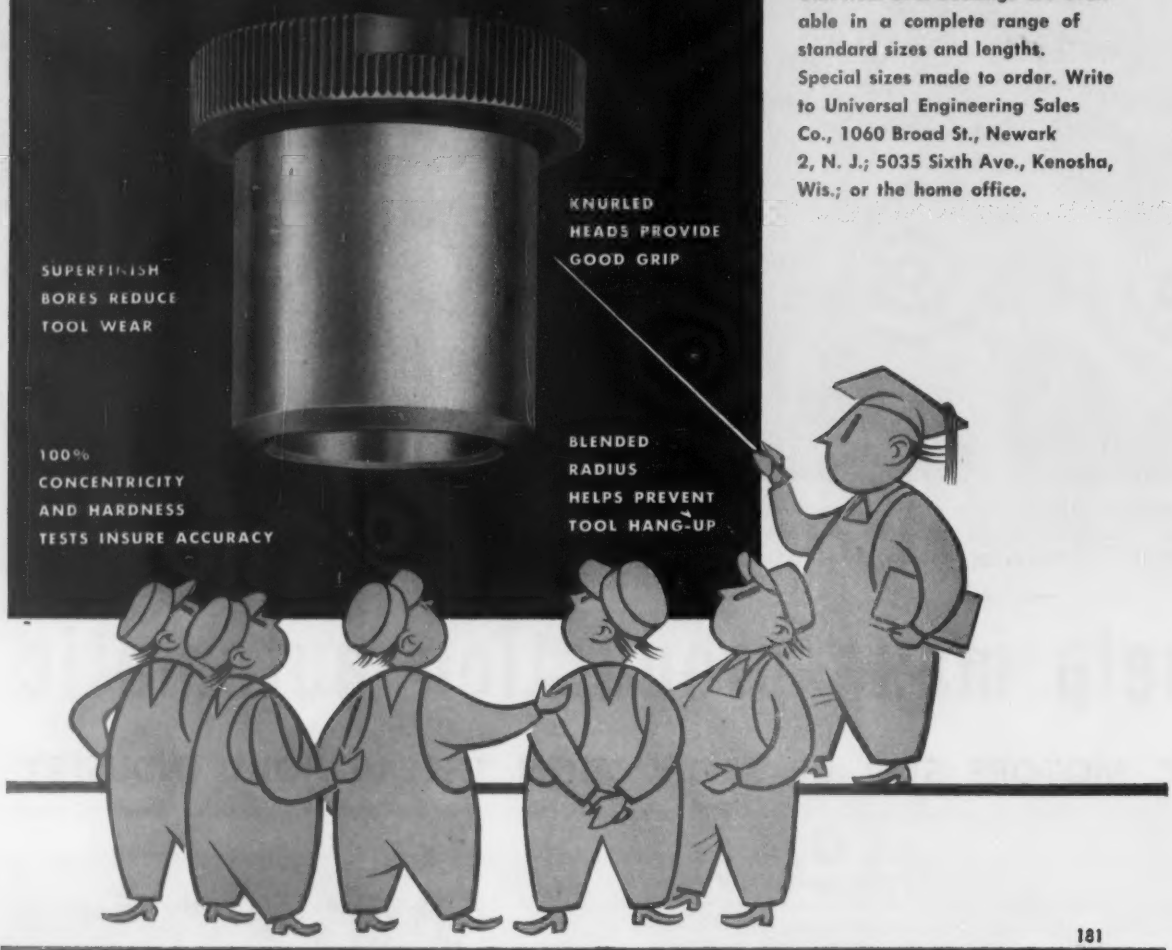


Excellent ventilating system gives positive ventilation to entire motor. Shaft fan on armature helps dissipate heat and keeps motor within rated temperature rise.

GENERAL ELECTRIC

UNIVERSAL DRILL BUSHINGS

INSURE PERFECT ALIGNMENT AND LONG LIFE OF PRODUCTION TOOLS


SUPERFINISH BORES REDUCE TOOL WEAR
KNURLED HEADS PROVIDE GOOD GRIP
100% CONCENTRICITY AND HARDNESS TESTS INSURE ACCURACY
BLENDED RADIUS HELPS PREVENT TOOL HANG-UP

Universal Drill Bushings are available in a complete range of standard sizes and lengths. Special sizes made to order. Write to Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.; or the home office.

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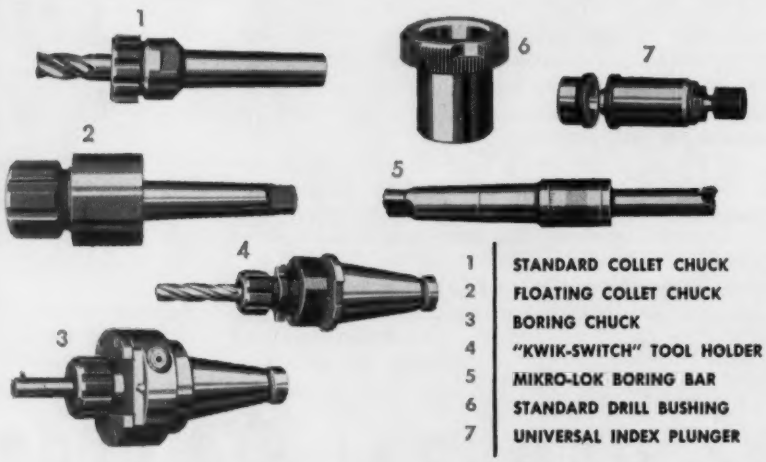
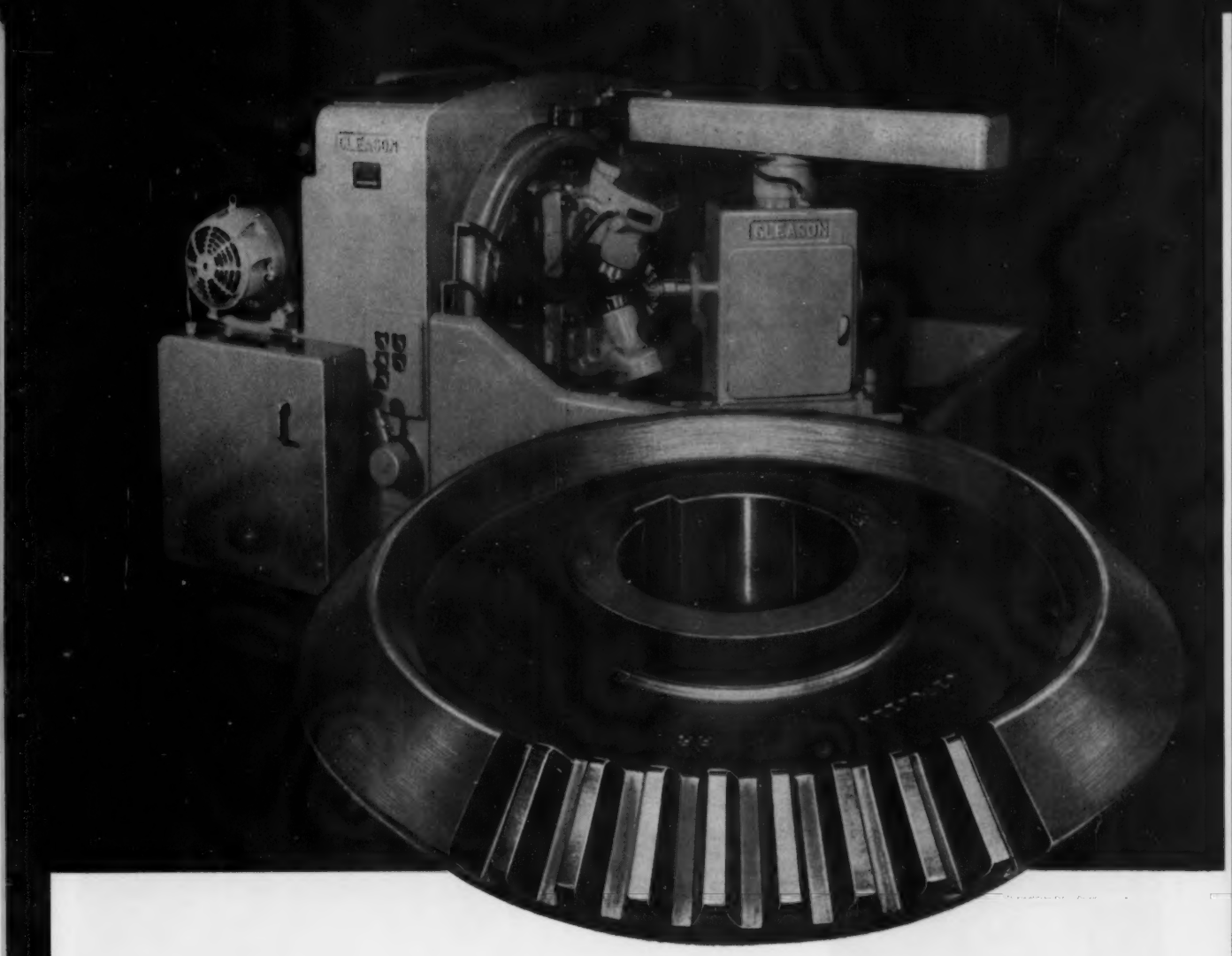
UNIVERSAL ENGINEERING COMPANY
FRANKENMUTH 2
MICHIGAN



1 STANDARD COLLET CHUCK
2 FLOATING COLLET CHUCK
3 BORING CHUCK
4 "KWIK-SWITCH" TOOL HOLDER
5 MIKRO-LOK BORING BAR
6 STANDARD DRILL BUSHING
7 UNIVERSAL INDEX PLUNGER

For more information on products advertised, use Inquiry Card, page 245



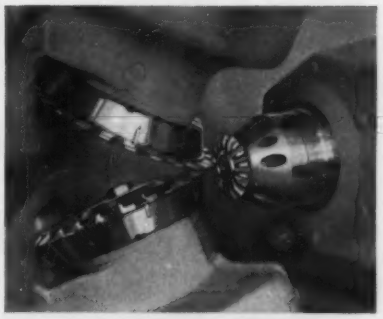
A complete gear for a fifth of a gear!

It all depends on the gear, of course. But, by the time an earlier model generator has cut one-fifth of a gear, the new No. 104 Straight Bevel Coniflex* Generator has *completed* a similar gear!

You can increase your production by as much as 500% with this new Gleason machine. You can get these results because this generator has two interlocking disc-type cutters with twenty-four blades each. These cutters complete a gear in *one rapid operation!*

But that is not all. The No. 104 is easy to set up—it has a wide range of capacity—it is excellent for small quantities or volume production. And, a new generating method insures high efficiency, fine finish, and maximum cutter life.

Write us and we will be pleased to send you a bulletin and further information on the new No. 104 Straight Bevel Coniflex Generator.



The No. 104 Straight Bevel Coniflex Generator completes gears up to 8½" diameter and 1⅜" face width, and from 20 to 3 DP.

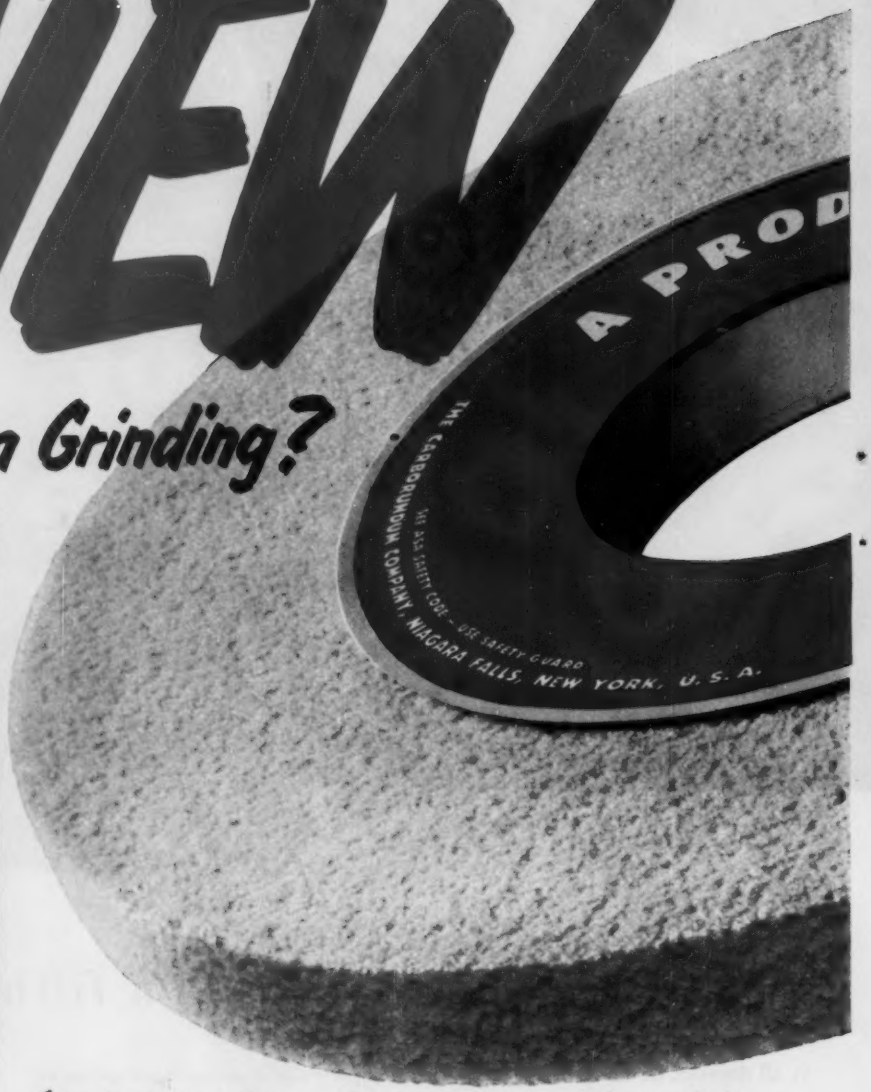
*Coniflex® straight bevel gears with localized tooth bearing.

GLEASON WORKS

Builders of bevel gear machinery for over 85 years

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

WHAT'S NEW in Tool Room Grinding?

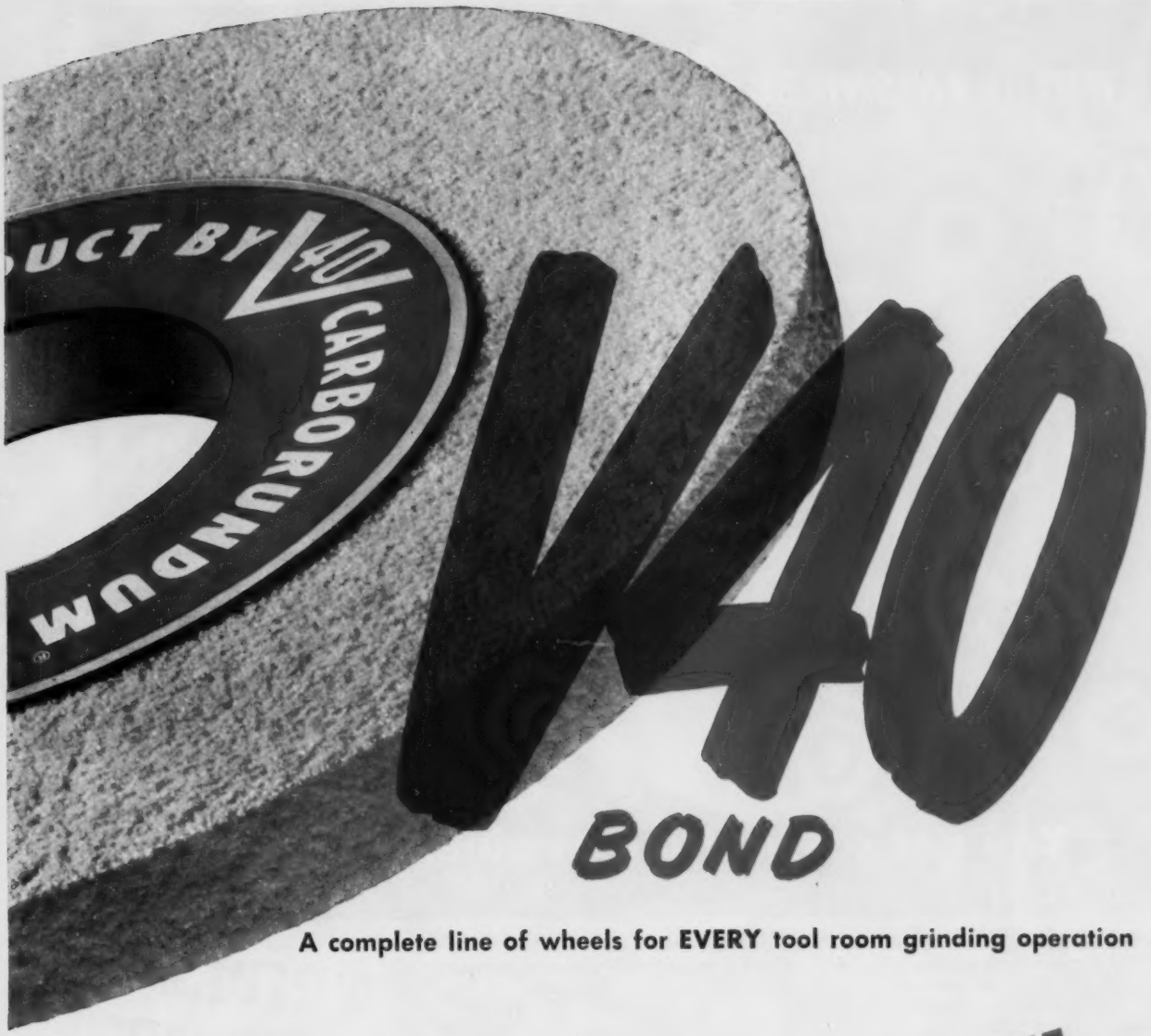


SUPERIOR PERFORMANCE

COMPLETE STOCKS—Immediate delivery from your CARBORUNDUM Distributor!

Call him, or your CARBORUNDUM Salesman (listed in the yellow pages under "Abrasives" or "Grinding Wheels") for full details on these outstanding V40 Bond Wheels and a demonstration in your own shop, on your own tools. Or write to the Carborundum Company, Dept. M, 81-414, Niagara Falls, New York.

...continually putting more sense in your abrasive dollar



A complete line of wheels for **EVERY** tool room grinding operation

...IN EVERY WAY

- **Cool and Free Cutting,** on high speed steels, even on hi-vanadium types.
- **Greater Form-holding Ability,** for longer wheel life, less edge breakdown, less dressing.
- **Easier Dressing,** because of special V40 bond composition, gives substantial savings in diamonds, time and abrasive.

EASY TO ORDER

You can usually order V40 Bond wheels in the same grit and grade as you are now using. (Specify AA Type abrasive in V40 Bond). But—that's where the similarity ends. For V40 Bond Wheels will outlast, outperform any other tool room wheel in your shop.

CARBORUNDUM

REGISTERED TRADE MARK

WHY IT PAYS TO BUY MECHANICAL TUBING FROM US

You get cost-cutting engineering help

● Our wide experience with all types of tubing problems has saved a lot of money for a lot of our customers. For example, we can often find a less costly type of tubing that will do a job as well or even better than a type that might cost more, but would not be "best" in that particular application.

You too may benefit from our accumulated "know-how." For no matter what type or size job you have, you can always depend upon us for thorough, up-to-date technical assistance.

And our more-than-complete tubing stocks—we carry 531 sizes of Shelby Seamless Tubing—means that you will get fast delivery of exactly the type you want. It's all top quality tubing too . . . manufactured by the National Tube Division of United States Steel.

So let *us* carry the costly, cumbersome tubing inventory that can meet your every requirement . . . competently, quickly. Call us when you need: mechanical tubing, round and square, seamless and welded; boiler tubing, pressure tubing and pipe; stainless steel tubing, seamless and welded, and stainless pipe.

TRIPLE SECURITY

What you want
When you want it
At the right price

U. S. STEEL SUPPLY
DIVISION

General Offices
208 So. La Salle St., Chicago 4, Ill.

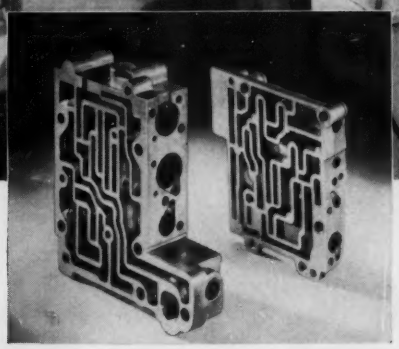
USS

Warehouses and Sales Offices
Coast to Coast

USS TRADE MARKS
SHELBY MECHANICAL TUBING
UNITED STATES STEEL

UNITED STATES STEEL

For more information on products advertised, use Inquiry Card, page 245



Holes on extremely close centers vary in diameter from 1/16" to 13/16". The valve body has 33; the cover, 18.

"—BUT OUR PRODUCTION RUN IS LIMITED."

"SO WAS THE RUN ON THIS AUTOMATIC TRANSMISSION PART, BUT". . . .

HERE'S HOW ZAGAR TOOLING SAVED MONEY HAND OVER FIST

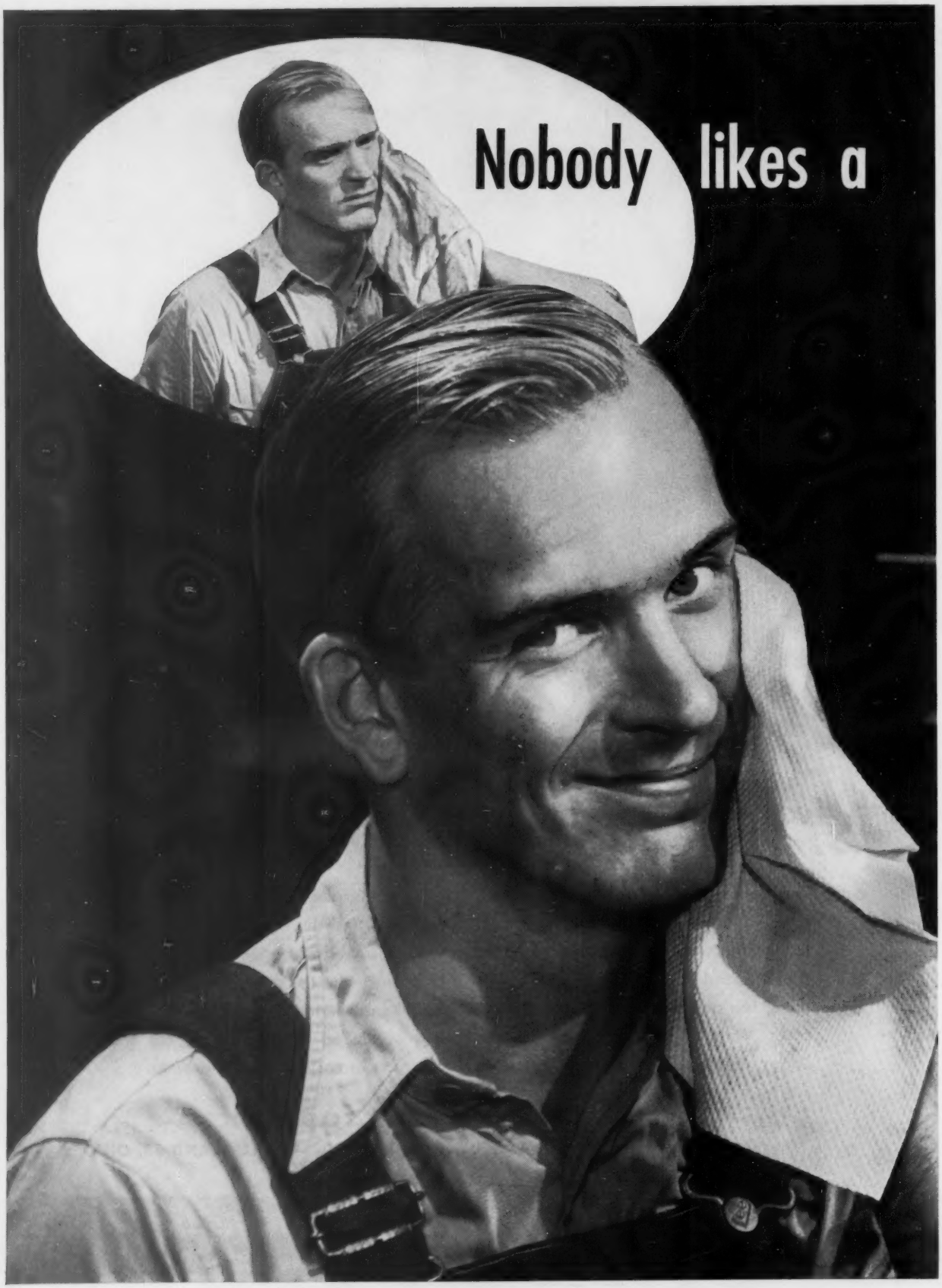
This aluminum die casting is processed in its entirety by Zagar planning, except for milling two faces. Two lines of Zagar standardized self-clamping drill jigs ream, tap and drill both valve body and cover. With 24 heads and 24 fixtures, Zagar performs work on 51 holes on close centers. Step tools take care of reaming and burnishing. The fixtures were designed to compensate for slight inaccuracies in the die casting. Thus has Zagar engineering solved an acute problem of limited production without the purchase of costly special machines.

Ask on your letterhead for Bulletin "M-12."

ZAGAR TOOL, INC.

24000 LAKELAND BOULEVARD • CLEVELAND 23, OHIO

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY


Nobody likes a

dirty wiper

...Another good reason for switching to **Scott Wipers!**

Because a clean, fresh one is always available—Scott Wipers provide a constant source of clean chip-free wiping material.

Scott Wipers are sanitary and disposable. They greatly reduce the costly scratches and digs in finished work caused by chips lodged in wiping materials. They end the laundering problem and simplify distribution and control.

Scott Industrial Wipers are two-ply and tough yet soft and absorbent. Compare them with whatever wiping material you're using now —for cost, for convenience, for performance.

The Scott representative or distributor in your area will be glad to help you set up a production line demonstration in your plant. Call him or mail this coupon today.

Scott Paper Company, Dept. M-3, Chester, Pa.
Please send me full information on Scott Industrial Wipers.

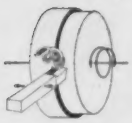
Name_____

Position_____

Company_____

Address_____

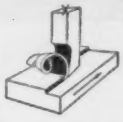
City_____ State_____



THE ENGINE LATHE uses a single-point tool restricted to chip-producing operations on the exterior surface of a rotating workpiece.

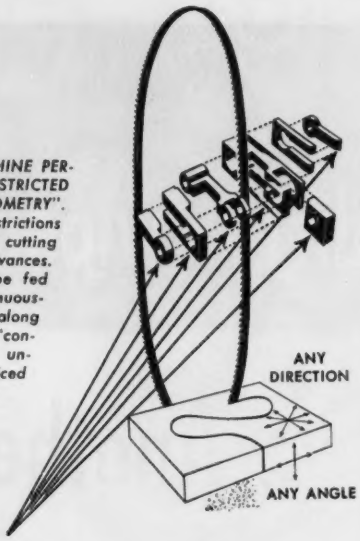
THE DRILL PRESS uses a revolving tool restricted to chip - producing operations penetrating into a fixed workpiece.

THE MILLING MACHINE uses a rotating cutter held in fixed position restricted to chip-producing cutting operations as workpiece advances.

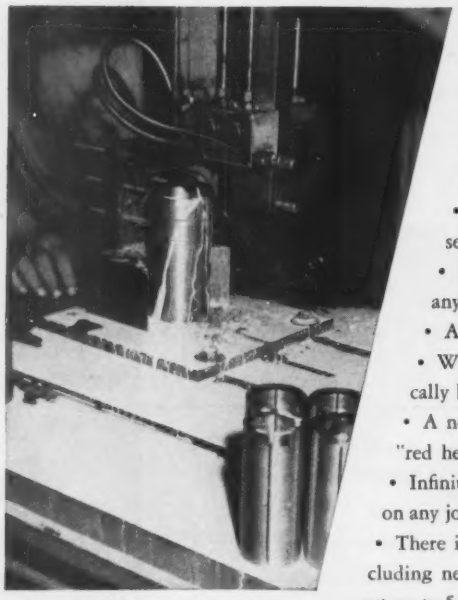


THE PLANER employs a single-point tool restricted to chip-producing, straight-line cutting on a plane surface as workpiece advances.

THE BAND MACHINE PERMITS "NON - RESTRICTED MACHINING GEOMETRY". There are no restrictions to the direction of cutting action as the cut advances. Hence, work may be fed to the narrow, continuous-cutting band tool along either a straight or "contoured" course. And unwanted material is "sliced off" in whole sections.



How the "non-restricted Geometry" of band machining can cut your costs!



Slotting operation on production parts being performed on DoALL Band Machine at half the cost of milling, the previous method used.

With modern DoALL Band Machines you can cut costs in slotting, splitting, cutting contours, cutting parts from the solid, notching and many other operations—*on a high production basis.* Here is why:

- New blades of high-speed steel provide revolutionary new production rates.
- The thin blade "slices" through metal, removing an entire section intact instead of whittling it down to a pile of chips.
- Straight cuts with good finishes can be made accurately at any angle to the face of the workpiece.
- Any internal or external shape or contour can be cut.
- Work is mounted on a tiltable table which feeds automatically by hydraulic power.
- A new built-in coolant system is employed with these new "red heat hardness" production band tools.
- Infinitely variable feeds and speeds provide optimum results on any job.
- There is a cutting tool for every job and every material including new DoALL *Demon high-speed steel* saw bands that cut up to 5 times faster and last up to 30 times longer than any previous saw band.

For a demonstration, call your local DoALL Store, or write: *The DoALL Company, Des Plaines, Illinois.*

DoALL

Band Machines, Saw Bands, Precision Surface Grinders, Precision Measuring Equipment, Black Granite Surface Plates and a Complete Stock of Cutting Tools at each of 38 DoALL Sales-Service Stores. Call DoALL.

PB-8

Free: New wall chart "*How Basic Tools Created Civilization.*" Make request on your company letterhead.

For more information on products advertised, use Inquiry Card, page 245

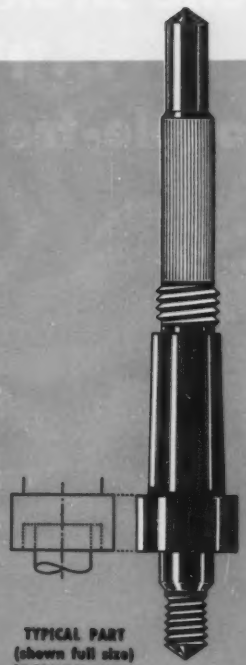
PETERMANN

AUTOMATICS

for close tolerances . . .

THIS NEWEST MEMBER OF THE *Petermann* FAMILY OFFERS NEW AND VALUABLE FEATURES SUCH AS:

1. Six (6) radial tools (all independently controlled).
2. Hydraulic buffer for shortening the time of return stroke.
3. Accelerator which speeds up the cam shaft during "idle time"
4. Speed box change for both spindle and cam shaft.
5. Automatic lubricating system.



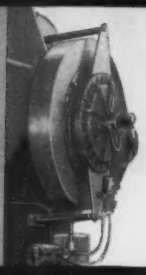
TYPICAL PART (shown full size) PRODUCED ON A PETERMANN AUTOMATIC

Complete tooling service and parts in America

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

another
Columbia
press brake feature



specially designed air clutch and brake

Self-adjusting clutch, installed in heavy, balanced flywheel, cushions shock, assures long, trouble-free service. Multiple spring-loaded brake stops ram automatically when clutch is disengaged.

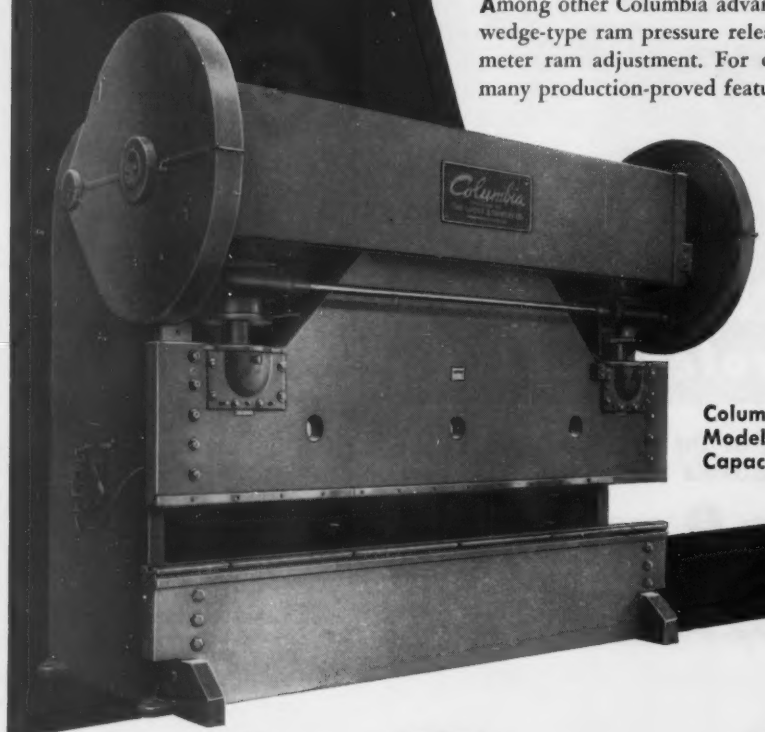
jogging or one stroke ...it's trouble-free

Columbia "New Series" Power Press Brakes incorporate years of experience in the heavy metal working field with time, labor and cost-saving features of the most advanced design.

Typical are the air clutch and spring brake, particularly designed for press brake service. The smooth operating, positive clutch is installed in a heavy, balanced flywheel. Drive to the gearing is by a heavy alloy steel shaft.

When the clutch is disengaged, the disc type friction brake is automatically applied, holding the ram in any position without creeping. The air clutch and brake are available on series 180 and larger size Columbia press brakes.

Among other Columbia advanced design features are the exclusive wedge-type ram pressure release and the motor-operated micrometer ram adjustment. For dependable performance, check the many production-proved features of rugged Columbia Press Brakes.



Get the complete story on exclusive Columbia press brake features. Write for new FREE Bulletin No. PB-1 and the name of your nearest distributor.

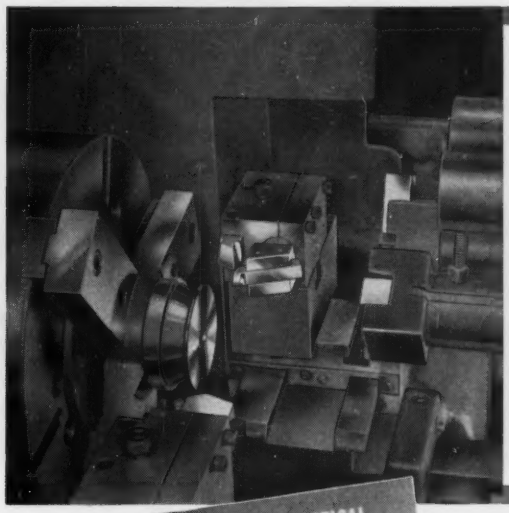
Columbia Power Press Brake, Model 180-12. Capacity, 12' x ¼".

COLUMBIA DIVISION THE **Lodge & Shipley** CO HAMILTON 1, OHIO

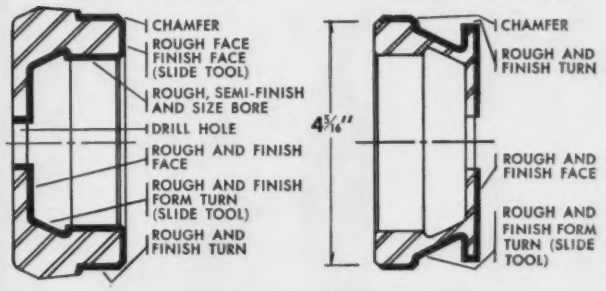
For more information on products advertised, use Inquiry Card, page 245

CUTTING SPEEDS OVER 1,000 Feet per Minute on STAINLESS STEEL FORGINGS

WITH THE NEW POTTER & JOHNSTON 4-U AUTOMATIC

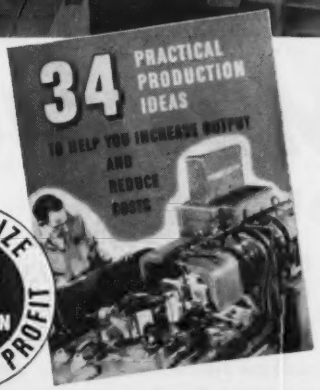


HERE ARE THE RESULTS!!



HEAVY LINES INDICATE MACHINED SURFACES

FLOOR-TO-FLOOR TIME, 5.54 minutes per piece (for both operations)



MODERNIZE with POTTER & JOHNSTON REPLACE FOR PROFIT

Performance like this is ***typical*** of the extra speed, output and economy you can expect with the new P&J 4-U Automatic. Designed and built specifically to handle today's tough alloys with greater efficiency, this rugged workhorse has the added power, spindle speed and rigidity needed to take ***full advantage of modern carbide tooling*** for faster metal removal.

Investigate this important opportunity for greater efficiency and increased profits. Send now for your free copy of the 4-U Circular and the "34 Ideas Booklet" to help you increase output and reduce costs.

WRITE DIRECT OR CONTACT YOUR NEAREST PRATT & WHITNEY BRANCH OFFICE

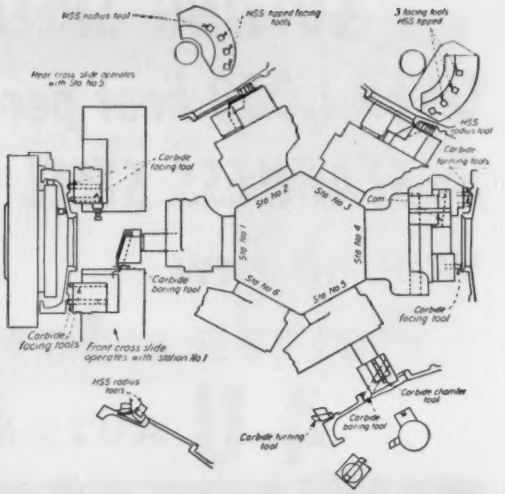
BIRMINGHAM • BOSTON • CHICAGO
CINCINNATI • CLEVELAND • DETROIT
LOS ANGELES • NEW YORK • PHILADELPHIA
PITTSBURGH • ROCHESTER • SAN FRANCISCO • ST. LOUIS
EXPORT DEPT., PAWTUCKET, R. I.

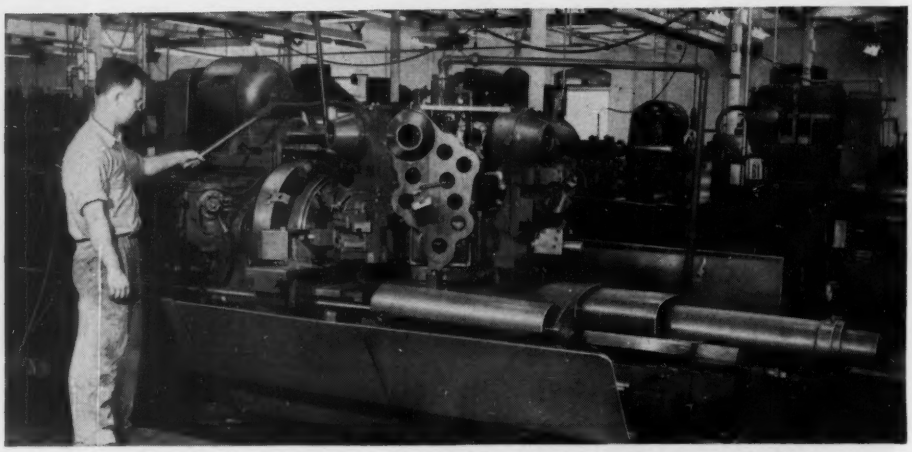
AGENTS: DALLAS, THE STANCO CO.
HOUSTON, WESSENDORFF, NELMS & CO.

POTTER & JOHNSTON CO.
PAWTUCKET, RHODE ISLAND
SUBSIDIARY OF
PRATT & WHITNEY
DIVISION NILES – BEMENT – POND COMPANY

PRECISION PRODUCTION TOOLING FOR MORE THAN FIFTY YEARS

how *Curtiss Wright* increases production





Note setup using both HSS and carbide tools to handle rough and finish cuts including 2 stations which sweep a circular swath about 2" wide.

with the

FASTERMATIC

automatic turret lathe

It's a complex machining job, this front end section for an aircraft engine. But the Fastermatic does it at a fast rate, handling 20 cuts in 37 minutes. That's because the Fastermatic has the rigidity to take multiple cuts at high speeds with carbide tools. What's more, it's all automatic operation.

Once the job is set, the machine does all the work—efficiently, and with repeat accuracy, piece after piece. Why not find out what it can do to increase your production and cut your costs?

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

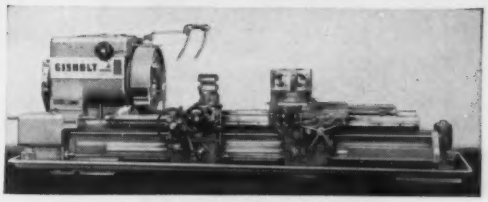
TURRET LATHES · AUTOMATIC LATHES · SUPERFINISHERS · BALANCERS · SPECIAL MACHINES

"Here's why GISHOLT insists upon the HEAVIEST CASTINGS!"

Look at them . . . castings for the heaviest saddle type turret lathes in the business! Look at all the angles:

First, note how the headstock is cast integrally with the bed for perfect spindle alignment . . . how cross supports give the most solid base for carriages, tools and slides . . . how extra-heavy webbing gives the headstock the ruggedness to support powerful gear train members.

Remember, too, that cast iron absorbs vibration. The heavier the better! And Gisholt controls the quality of the finest nickel semi-steel in its own foundry.



The Gisholt 5L Saddle Type Turret Lathe has a net weight of 22,500 lb. without equipment.

What does it mean to you? You can load up your Gisholts with carbides and really turn out the chips! You've got the strength, the rigidity and the freedom from vibration to take all the speed you can get from today's carbides—with the heaviest feeds—and still have the safety margin to take care of tomorrow's tool bit developments.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

TURRET LATHES · AUTOMATIC LATHES · SUPERFINISHERS · BALANCERS · SPECIAL MACHINES

ARMSTRONG WRENCHES

Choose Your Wrenches as you do your friends--for life

Specify ARMSTRONG Wrenches for lifetime service, for finely balanced tools that feel right in the hand and make work easier, faster and less fatiguing. ARMSTRONG Wrenches generally are longer for size—give greater leverage. Accurately milled or broached openings give the proper clearance. They are safe wrenches because they are strong beyond need.

Drop forged and machined from high tensile carbon or special alloy tool steels, ARMSTRONG Wrenches are heat treated, tempered and tested to an exact balance of toughness, hardness and tensile strength. Each is beautiful in finish and line, is a quality tool to be proudly possessed by any mechanic—or certain to "give a lift" to any assembly line. Buy wrenches which carry the trade marks HI-TEN or ARMALOY. On carbon or alloy steel wrenches these trade marks are your guarantee of lifetime quality.

WRITE FOR CATALOG

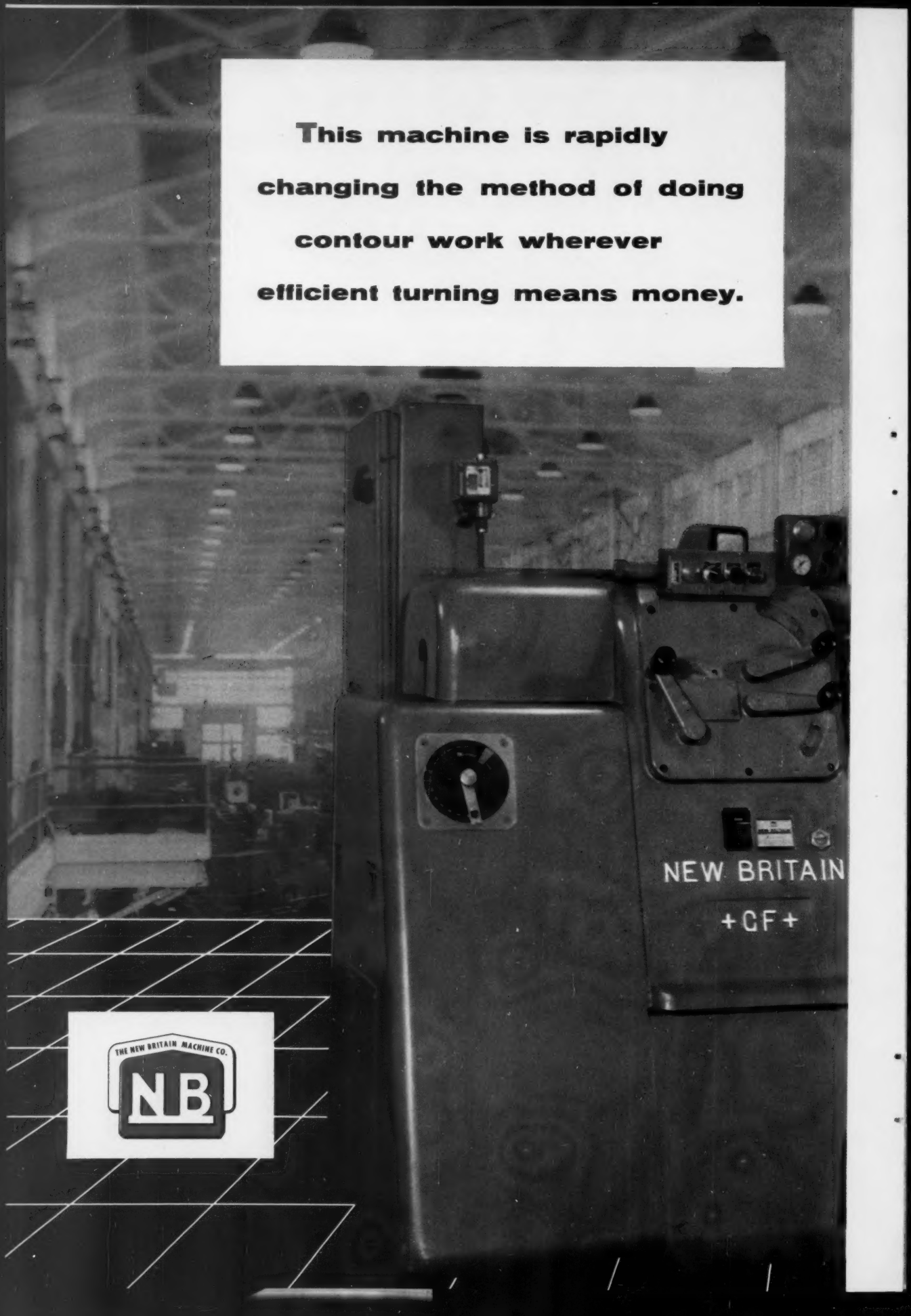
ARMSTRONG BROS. TOOL CO. *"The Tool Holder People"*
5213 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

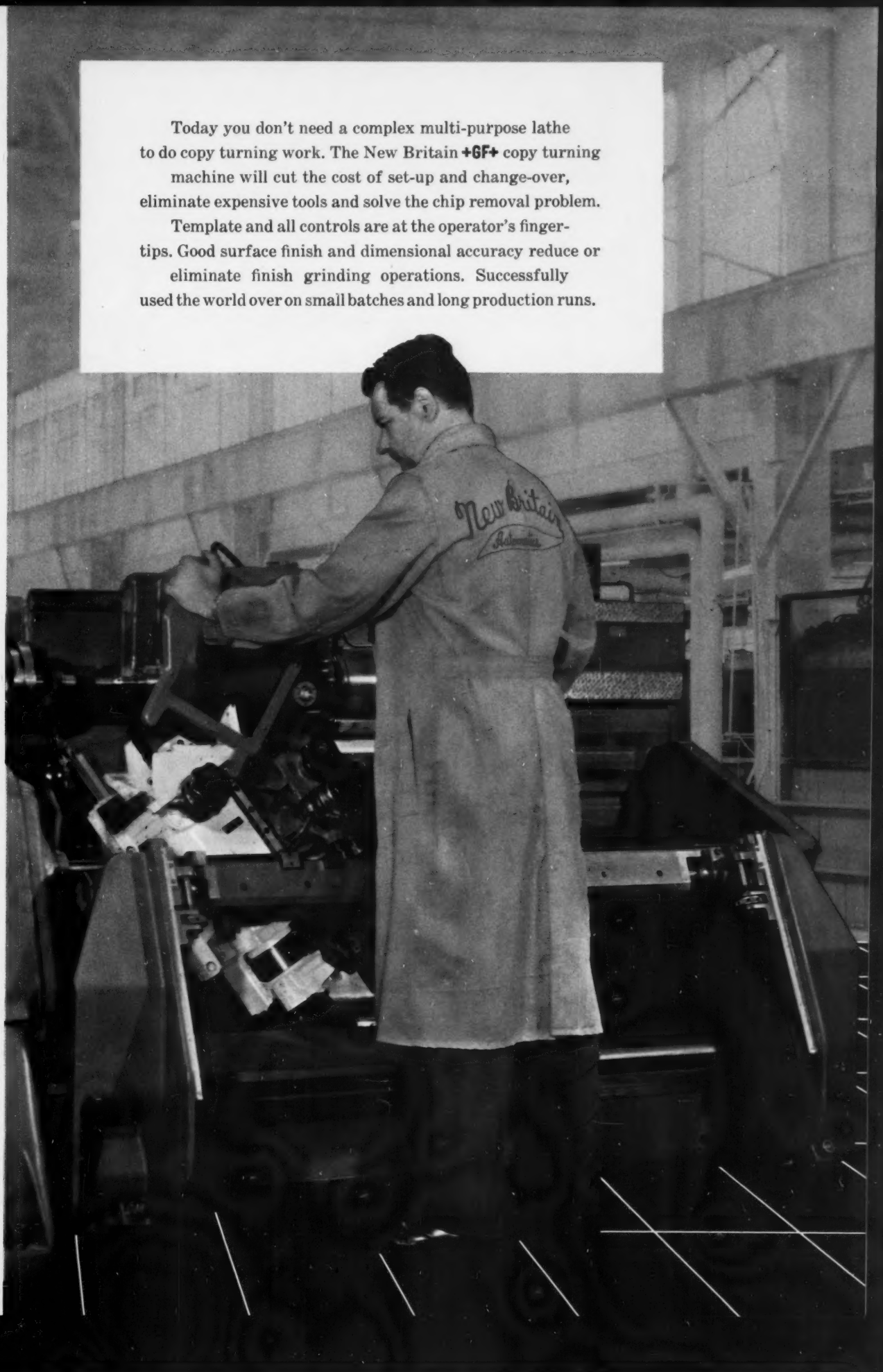
For more information on products advertised, use Inquiry Card, page 245

You get EVERY important improvement in EVERY Lucas

Whether your work calls for a three, four, or five inch precision horizontal boring, drilling and milling machine, you will get all the major features of any machine and some not obtainable in others when you pick a Lucas. For example:

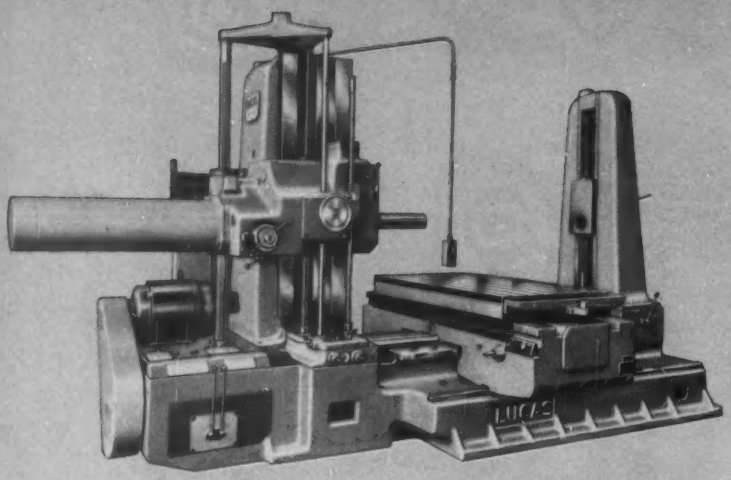
• AUTOMATIC POWER POSITIONING • INTEGRALLY CAST 4-WAY BED • COMPLETE RANGE OF FEEDS & SPEEDS TO ONE SPINDLE • SIMPLIFIED PENDANT (TWO LEVERS DO THE WORK OF TEN BUTTONS) • VIBRATIONLESS TOOTHED BELT DRIVE TO SPINDLE AT HIGH SPEEDS • FLAME HARDENED WAYS • CHROME PLATED LEAD SCREWS


This machine is rapidly
changing the method of doing
contour work wherever
efficient turning means money.
NEW BRITAIN
+CF+
THE NEW BRITAIN MACHINE CO.
NB



Today you don't need a complex multi-purpose lathe to do copy turning work. The New Britain +GF+ copy turning machine will cut the cost of set-up and change-over, eliminate expensive tools and solve the chip removal problem.

Template and all controls are at the operator's fingertips. Good surface finish and dimensional accuracy reduce or eliminate finish grinding operations. Successfully used the world over on small batches and long production runs.

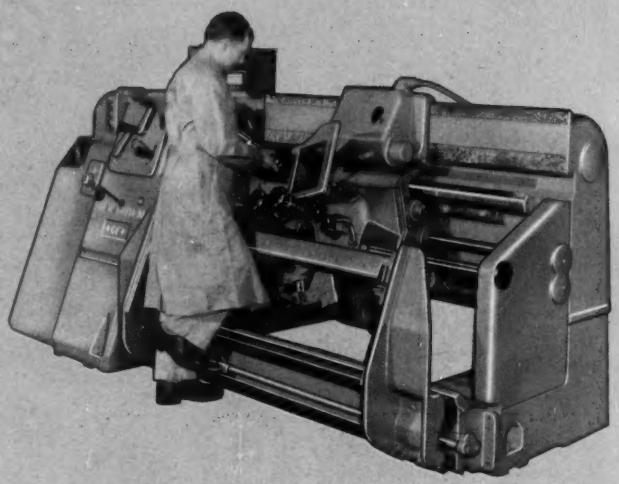


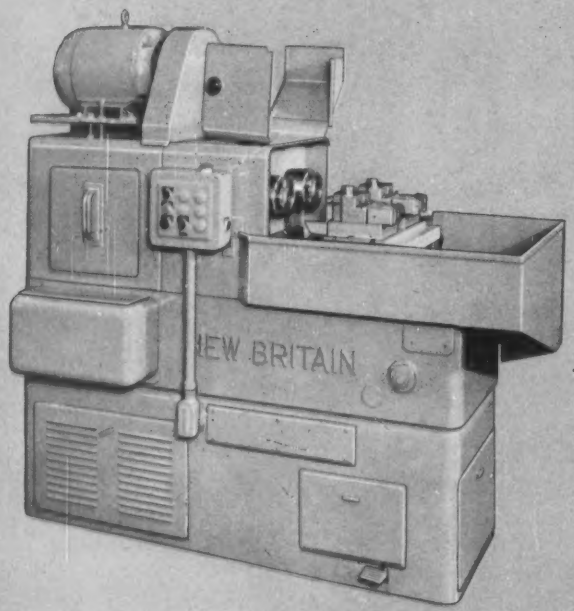
LUCAS PRECISION

A Lucas Precision Horizontal Boring, Drilling and Milling Machine will perform many operations in sequence on one piece or a thousand, from small components to large weldments. It will not only make heavy roughing cuts but will also finish to the close tolerances required in precision manufacturing. Quickly set up for short runs. Incorporates Automatic Power Positioning for multiple operation work.

NEW BRITAIN +GF+

The New Britain **+GF+** copy turning machine is built on a new principle with copying saddle mounted below the spindle and on conventional lathe bed. Chips fall free and accumulate through the back of the machine. Power operated tail stock, centralized controls and front mounted prototype or template reduce operator fatigue. Powerful drive and a wide variety of speed and feed ranges make the New Britain **+GF+** a profitable producer on short or long runs.





NEW BRITAIN PRECISION BORING MACHINES

include vertical, horizontal and double end models — a complete line for both straight and contour work. New Britain's exclusive application of cam control gives your tool engineer a completely new approach to tooling, for complex pieces. Methods impossible on other types of machine can be employed to speed production, simplify tooling, eliminate finish operations and assure repetitive accuracy on a wide variety of work.

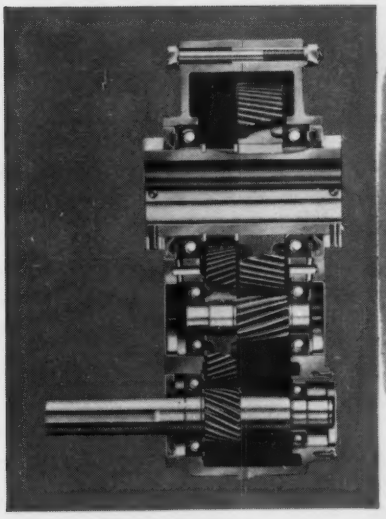
Our general catalog is filed in the Sweet's Machine Tool Catalog File.

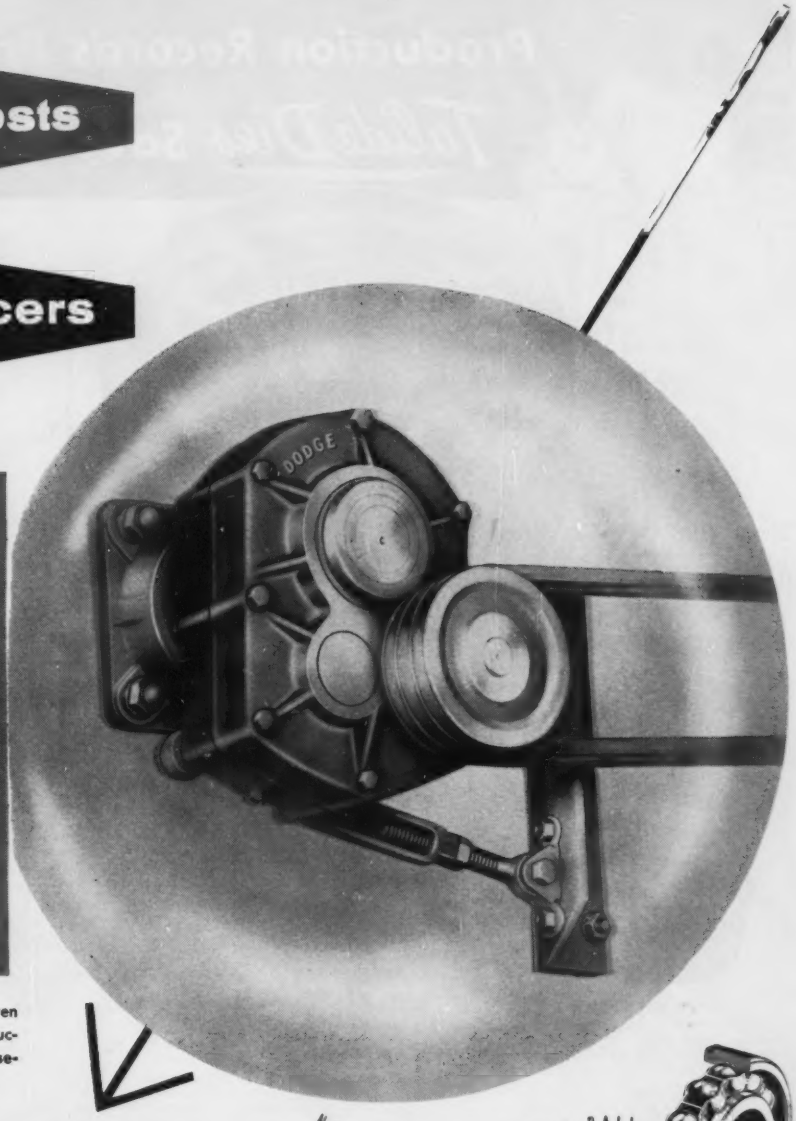
AUTOMATIC BAR and CHUCKING MACHINES • PRECISION BORING MACHINES
LUCAS HORIZONTAL BORING, DRILLING and MILLING MACHINES
NEW BRITAIN +GF+ COPYING LATHES

The NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division, New Britain, Connecticut
Lucas Machine Division, Cleveland 8, Ohio

Reducing Costs in Speed Reducers





New Departure **ball** bearings are used in seven basic sizes of the Dodge single and double reduction speed reducers, handling from 1 to 43 horsepower at output speeds from 12 to 330 r.p.m.

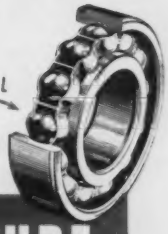
. . . with NEW DEPARTURES

Dodge Manufacturing Corporation's Speed Reducers make good use of design advantages offered by New Departure snap-ring **ball** bearings.

The snap rings locate the bearings in the case, eliminating the need for adjustment. Doing away with threaded or shim-type devices permits straight-through boring of the housing. Thus split-case construction is highly practical, and assembly is greatly simplified. The result is a rigid, highly efficient unit, and one in which production costs have been kept to the minimum.

Learn what New Departure can do for *your* product. Talk with your New Departure sales engineer—*today!*

NOTHING ROLLS LIKE A BALL



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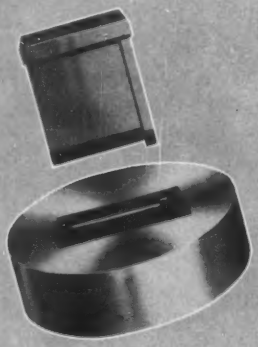
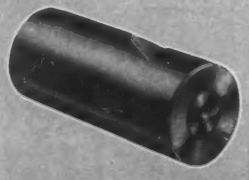
Production Records Prove *Talide Dies* Save You Money

● 137,000 hi-alloy steel Pressure Vessels deep drawn through a TALIDE Sheet Metal Die—with buffing and polishing costs cut 80%—downtime 98%—and scrap 100%. Best production from steel die used previously was 7,900 cylinders before wearing oversize.



BLANKING AND FORMING DIES

Over 5,000,000 abrasive paper discs blanked out with a TALIDE Blanking Die—70 times more than produced with hard alloy dies used previously.

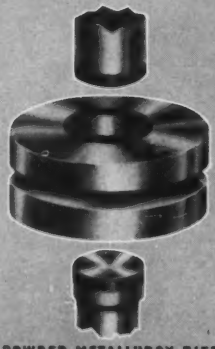


HEADING AND EXTRUSION DIES

Costly cold-heading job on 3/4" carriage bolts producing only 50,000 pcs. per steel die made profitable with average 1,500,000 piece production runs with TALIDE Cold-Heading Dies.

CURLING ROLLERS

Large Can Company reports TALIDE Curling Rolls last 65 times longer than steel rolls on beverage can forming operation—with edges free from burrs and cracks.

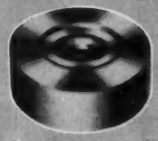


POWDER METALLURGY DIES

Large Pharmaceutical Company reports TALIDE Pill Dies not only produce tablets having a superior surface glaze which reduces rejects 82%—but also outlasts steel dies 100 to 1.

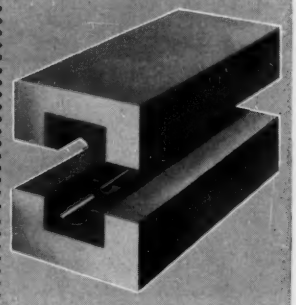
TUBE MANDRELS

12 days (36 shifts) of continuous trouble-free production obtained by eastern Brass Mill with TALIDE Tube Drawing Mandrels—compared to average 8-hr. runs obtained with steel mandrels.



DRAWING DIES

50 miles of tough 5" alloy steel tubing (actually 25,000 ft.) drawn by large midwestern Steel Mill through TALIDE Tube Die compared with a normal run of 10,000 ft. with a steel die.



SWAGING DIES

Leading Fountain Pen Manufacturer cold swages an average of 750,000 stainless steel sleeves with TALIDE Swaging Dies — 33 times more than with chrome-plated dies.

● Available in size range from .010 to 24" I.D. and in any shape, Talide Dies meet every requirement. Uniform quality and consistent performance are assured by 21 grueling tests including physical, chemical and metallographic. Send us prints or parts of your particular die application for estimate and recommendations. **Metal Carbides Corp., Youngstown 7, Ohio.**

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OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

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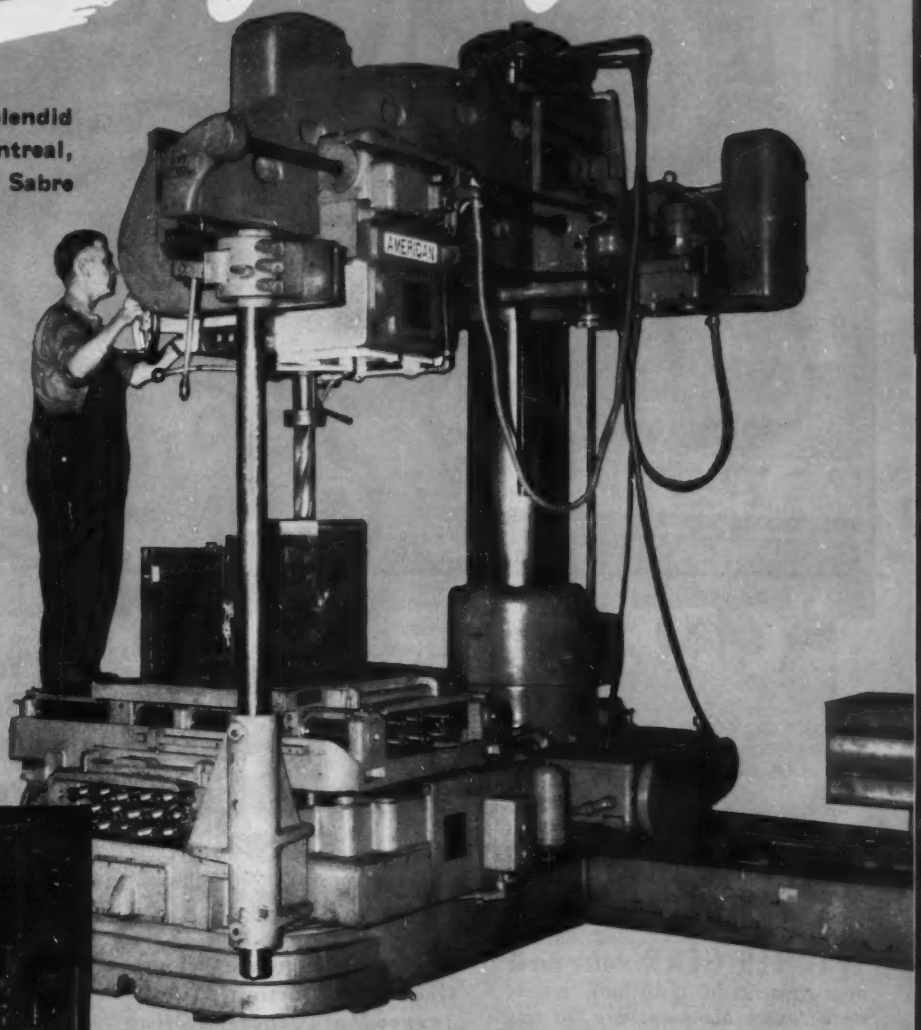
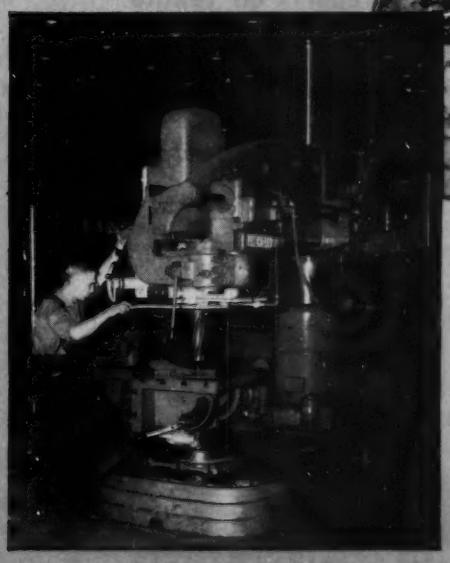
On TOP of his job!

This operator is doing a splendid job at Canadair Limited, Montreal, on the production of F-86E Sabre Jets for the RCAF and, as the illustration shows, he is right on top of his job, too.

He is proud of his fine new 6' 17" column "AMERICAN" Hole Wizard Radial. "It's powerful; it's sturdy; it's easy to operate, and I'm not worn out at the end of the day". What more could any operator ask? As a consequence he turns out a lot of fine work which makes his machine a paying investment for the company.





This *"American"* Hole Wizard Radial has a right angle base, on one wing of which is mounted a Bullard Man-Au-Trol Spacer—as shown by the illustration.

"AMERICAN" Hole Wizard Radials are playing a prominent part in the production of critical defense items for both the U. S. A. and Canada.

For a complete revelation of their virtues send for descriptive bulletin No. 327.

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"GREATER LOADS ... MINIMUM DISTORTION"

Warner Gear Division, Borg-Warner Corp., Muncie, Indiana, reports on Texaco Marquenching Oil

WARNER GEAR notes great improvement in quenching results since *Texaco Marquenching Oil* was introduced.

"Results have been far beyond our expectations," says the company's report. "With Texaco Marquenching Oil we are handling greater loads than we ever could with ordinary quenching oils and of greater importance are getting less distortion. We like Texaco Marquenching Oil so much that we are extending its use to our other plants."

Other companies are getting similar results with *Texaco Marquenching Oil*. Users say it assures them the desired microstructure, reduces distortion and gives uniform hardness—all at a lower cost. *Texaco Marquenching Oil* is made especially for this service. It has outstanding oxidation-resistance, is always uniform in quality, and has a high flash point.

Let a Texaco Lubrication Engineer give you the full story. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

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TEXACO OILS FOR QUENCHING MARQUENCHING AND TEMPERING

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By LORING F. OVERMAN

Accelerated Spending Pace for Defense

A NEW pattern is emerging in the Washington defense picture. It may be due to increased concern over world affairs. It may reflect completion of the experimental stage in weapons development. It may mean that the heads of the Department of Defense are finding it easier to yield to the "more and bigger defense facilities" argument than to hold out for the "bigger bang for a buck." Whatever the reason, the word has gone out that there must be increased appropriations for defense in the half-dozen years ahead, starting as of right now.

Topping Present Appropriations

Defense Secretary Charles E. Wilson has indicated that Congress, in making new appropriations for 1956 and beyond, will be asked to provide defense funds in excess of the $29,500,000,000 appropriated for fiscal 1955. Expenditures during 1954 and 1955 have been somewhat in excess of that figure, due to hold-over amounts unspent from previous years. Such windfalls will end soon, and it will then be necessary to put up additional appropriations to meet increasing commitments.

A new cycle of stepped-up spending started as soon as Congress passed the 1955 budget, according to Mr. Wilson, and the accelerated pace may be expected for several years. He said, "The Defense Department will continue to need billions of dollars' worth of equipment to keep our military departments up-to-date and ahead of any possible aggressor. We will need all kinds of improved weapons, including supersonic planes, guided missiles, radar and electronic equipment, and the new technical devices that are being developed by industry and the three Services."

Machine Tools "Essential"

In the new plans, machine tools and other production equipment are being accorded top billing, at least on paper. Washington appears to recognize the importance of keeping the tool reserve up-to-date, but how to keep it in readiness for quick action is a continuing problem.

Ever since the Vance plan of investing some $500,000,000 a year in keeping defense tooling in constant readiness, Washington has booted the idea around like a football. The first installment of the Vance fund was pared down from $500,000,000 to $100,000,000, but no application was ever made by the Services for even this reduced amount.

It now appears that there is general agreement, at least within the Office of Supply and Logistics, on how to invest the first $100,000,000. The program has been under study for more than a year and a half, with the approval of President Eisenhower and Defense Secretary Wilson as the remaining hurdles.

The United States Air Force is reported as being high on the list of beneficiaries, with the Navy second, and the Army a poor third. Stretch presses, requiring some thirty-six months lead time, as well as skin milling machines and turret lathes, are said to interest the Air Force.

Indications are that this commitment of the first $100,000,000 for machine tools, if approved, will be merely the starting point. Industry-Service teams, which have been checking present Service stocks of production equipment, indicate that obsolescence may exceed 40 per cent. This would mean that, despite efforts to keep the production equipment reserve in shape, there is still need for a long-range program of care, storage, and replacement.

In addition to the Defense Department program, the Office of Defense Mobilization is working on a $40,000,000 schedule of "elephant" tools. Discussion indicates that the ODM program, if and when approved, might eventually call for double this sum.

NOT all of the machinery developments in defense are in machine tools. ODM Director Dr. Arthur S. Flemming stated, "We have under way a study of our capacity to produce approximately fifty components, such as anti-friction bearings, fractional horsepower motors, aircraft instruments, turbines, turbine gears—items which have been bottlenecks in past emergencies. When these studies identify deficiencies in our ability to produce, we intend to use authority under the Defense Production Act to stockpile the tools and equipment necessary to increase our capacity to meet mobilization needs in these critical areas.

"Our stockpile of strategic and critical materials is now valued at $4,500,000,000. Before we reach our minimum objectives, it will be necessary for us to spend another $2,500,000,000. We are following the policy of achieving our minimum objectives just as rapidly as supplies become available, and without creating undue hardship for the civilian economy."

Leasing Proves Problem

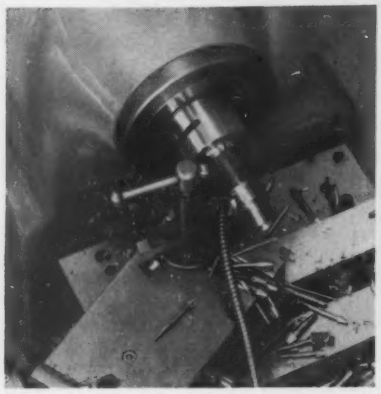
One of the troublesome offshoots of any surplus is the question of disposal. Machine tools and production equipment are no exceptions. Thus the Military Services, finding themselves the owners of valuable idle equipment, are understandably tempted to convert them into cash through leasing. Similarly, the Services are subjected to pressure by would-be lessors who would like to convert such idle equipment into producing units—at suitable discounts, of course.

A recent ODM proposal which would permit the Army, Navy, and Air Force to control the leasing of tools in the defense reserve, subject to ODM veto authority, drew immediate criticism from the National Machine Tool Builders' Association. The importance of considering machine tools as a critical defense reserve, and not merely as a unit of production equipment, was explained by Herbert L. Tigges, president of the Association.

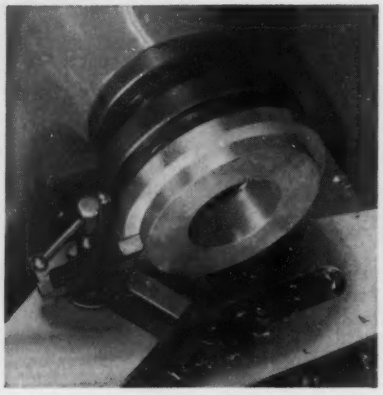
"If the leasing practice should gain headway in all three of the defense services," he said, "it would be only a matter of time until the national defense machine tool reserve would be scattered. Twice before we have witnessed the sudden enormous need for machine tools. Now when we have an opportunity to retain a reserve against such emergency, it certainly would seem folly to dissipate it. Control of leasing of government-owned machine tools should be kept in the hands of the Office of Defense Mobilization, which is not subject to the same type of budget pressures as are the Army, Navy, and Air Force, and is committed to the policies and objectives of the Vance plan."

HARDINGE
ELMIRA, N.Y.

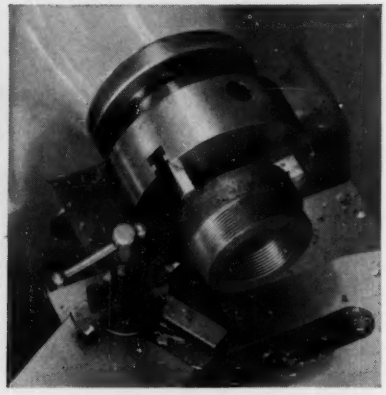
"The Outstanding Tool Room Lathe"



Precision Collet work for all sizes to 1/16" Collet seats *directly* in spindle.



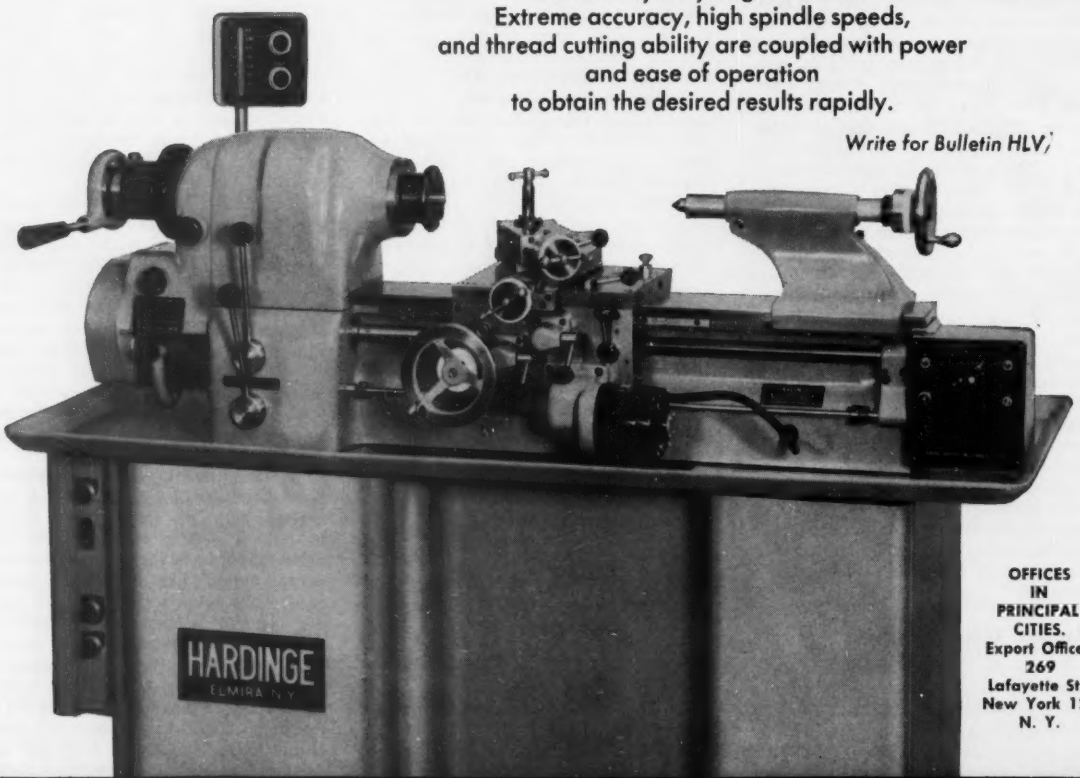
Precision Step Chucks for diameters up to 6". Provides Collet-like accuracy.



Integral Mount Jaw Chucks for precision holding of regular or irregular shapes up to 5".

Hardinge Model HLV 10" Lathe was primarily designed to fill a very old existent gap between the plain precision bench lathe and the heavy duty engine lathe.
Extreme accuracy, high spindle speeds, and thread cutting ability are coupled with power and ease of operation to obtain the desired results rapidly.

Write for Bulletin HLV,



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HARDINGE BROTHERS, INC., ELMIRA, N. Y.

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MACHINERY
DECEMBER 1954

Democratic Capitalism the Best Way of Life

IN Soviet Russia today, the average worker must toil 43 per cent longer than he did in 1928 to buy the weekly supply of seven foods that are most important to him and his family—bread, potatoes, beef, butter, eggs, milk, and sugar. The money earned during 78 per cent of his forty-eight-hour week is spent on these items alone if he wants to be as well fed as he was twenty-six years ago. In New York City, the average workman puts in three and one-quarter minutes to earn a sum equal to the cost of one pound of sugar—in Moscow, he works over forty-three minutes. Red leaders call *that* progress in their so-called workers' paradise!

The lot of the American workman is so vastly superior as to be practically beyond comparison. In addition to the obviously greater purchasing power of his weekly wage, despite considerably shorter hours, there are many fringe benefits that make his actual wage substantially higher. To determine his actual wage, it is necessary to take into consideration the sums of money that his employer pays for social security, unemployment compensation, group insurance, vacations, holidays, and other benefits. The cost of fringe benefits for an employe averaged $720 in 1953.

Free enterprise has given our workers these economic and social advantages. Why is it then that, whenever things go wrong with our economic system, business is the principal "whipping boy"? Millions of people are easily swayed on such occasions to believe that the trouble stems from "too much big business" or "too much free enterprise."

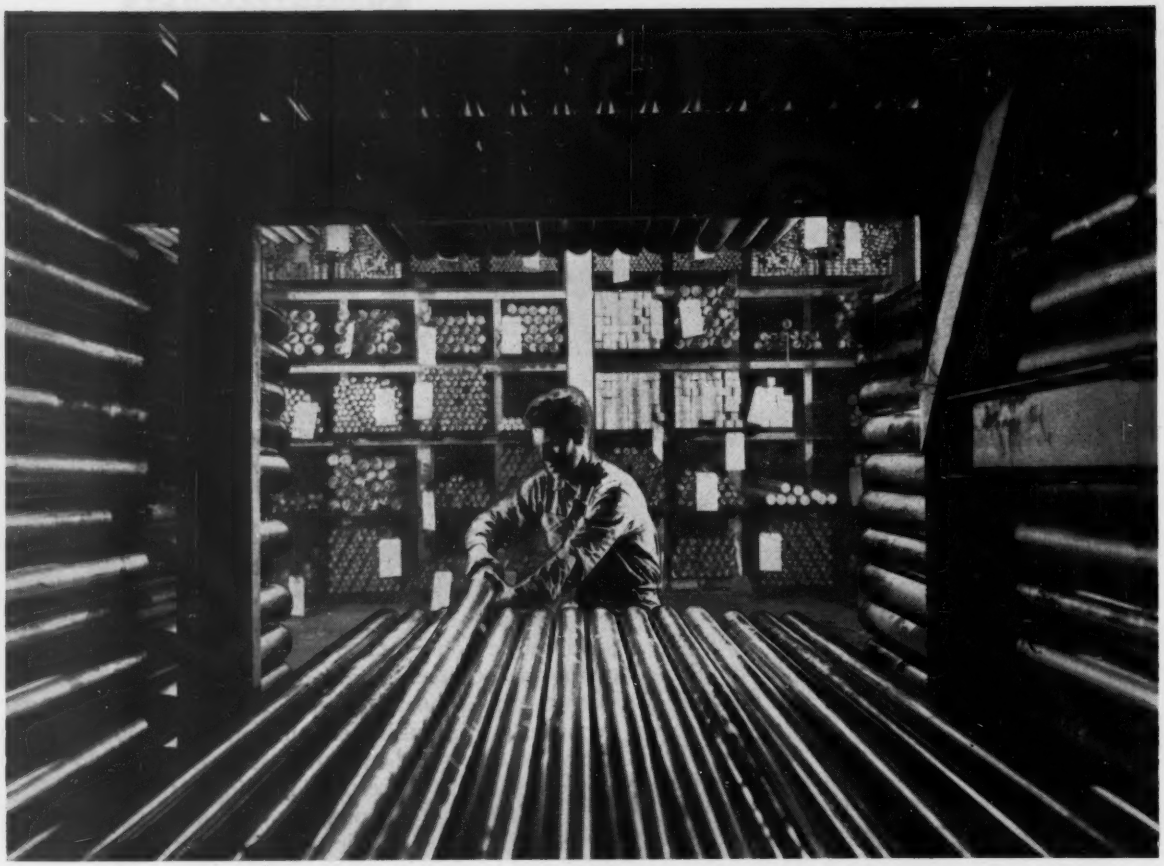
The truth of the matter is that, while business has been most proficient in developing democratic capitalism in cooperation with its employe personnel, it has been singularly lackadaisical in publicizing the fundamentals on which our world-envied economy is based. Although highly successful in selling its products at home and abroad, in not taking the time to sell itself, American business has been guilty of neglect in promoting its ideas and beliefs. Unless business tells its story effectively, rabble-rousers will continue to use it as a target.

Today we are privileged to have a Federal Government that is fundamentally as friendly to business as it is to other groups of the population. Now is the time for businessmen to make real efforts to convince the people of America and of the world that democratic capitalism is the best way of life yet to be developed by man.

"Of their own merits modest men are dumb" wrote an Eighteenth Century author. But let us not lean so far backward in our modesty as to jeopardize the American economic system!

Charles O. Herb

EDITOR



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Thousands of tons of certified alloy steel in 1698 different sizes, shapes, analyses and conditions await your call at Ryerson. New leaded alloys are on hand in three different carbon ranges. Standard analysis steels are supplemented by a wide range of aircraft quality alloys. No matter what your alloy requirement, you can depend on Ryerson for quick delivery of highest quality steel.

You won't need to check or test your dependable Ryerson alloys before you use them because every bar has been spark tested and identified with its own heat symbol—every heat has been hardenability tested for you as part of an 8-step quality control plan. And should problems of application or fabrication arise, Ryerson alloy metallurgists will gladly put years of practical experience to work for you.

No order is too large to fill from stock, no order too small for quick personal service—so, next time you need alloy steel call your nearby Ryerson plant.

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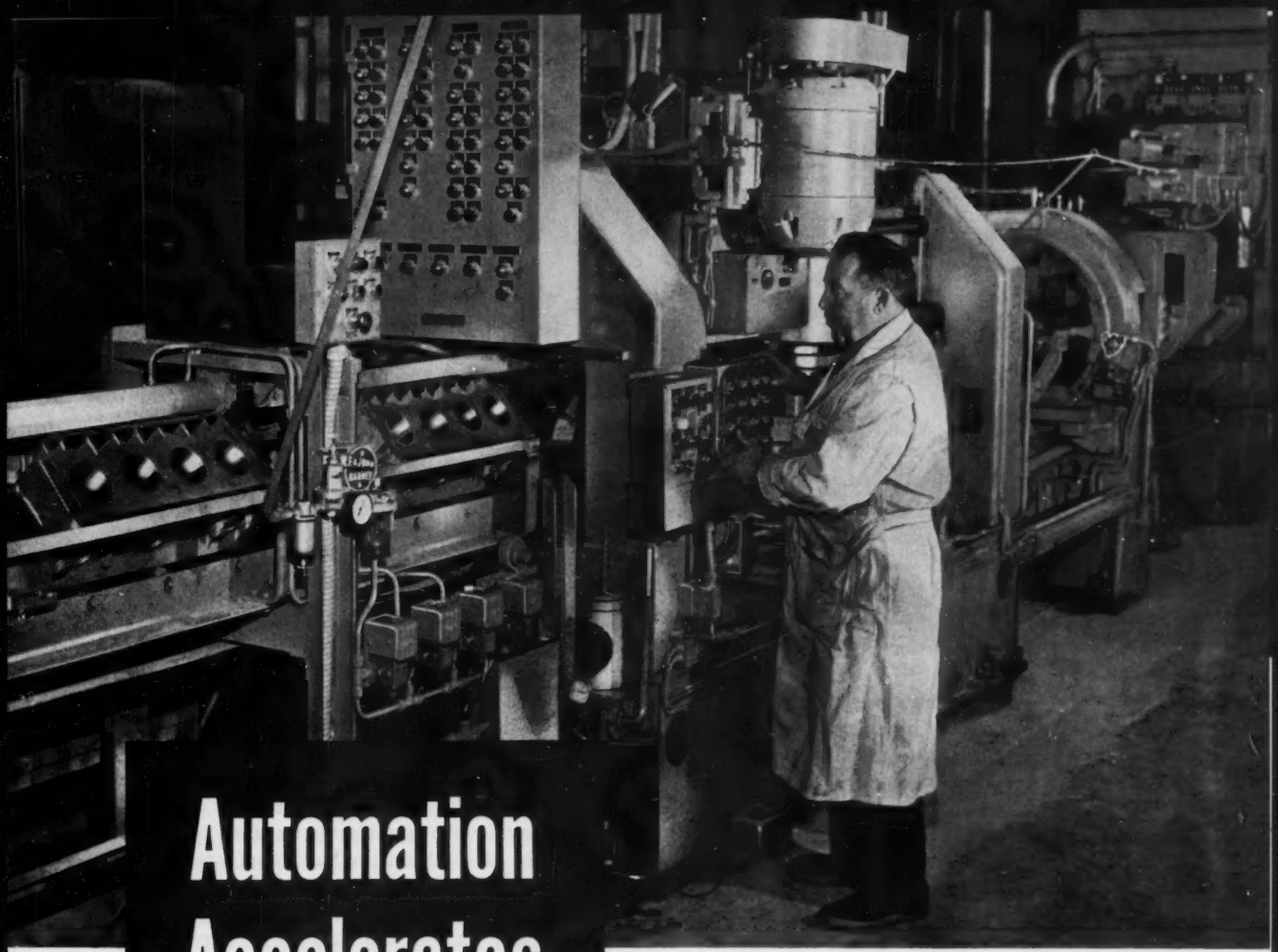

Automation Accelerates Packard V-8 Engine Production

Major step in a huge modernization program is the building of Packard's first V-8 engines in its new plant at Utica, Mich., equipped with advanced-design automation units and completely automatic machine tools

By CHARLES H. WICK
Associate Editor

AN outstanding feature of Packard's all-new 1955 automobile models will be two V-8 engines having high horsepower ratings. These engines, together with axles and automatic transmissions, are being manufactured in a new, single-story plant, containing 1,000,000 square feet of floor space, at Utica, Mich.

This facility marks the first major step in a huge manufacturing modernization program, and is the largest industrial move in the company's fifty-five-year history. The plant has been equipped with

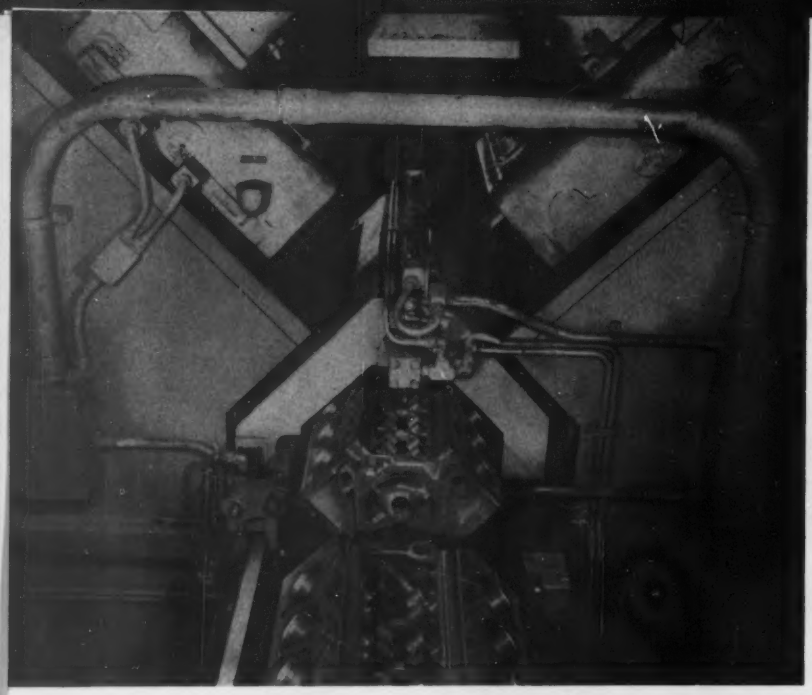

Fig. 1. Selector mechanism at the sixth station of third transfer machine automatically feeds blocks for higher horsepower V-8 engine into this cylinder boring unit, and blocks for lower horsepower engine into another.

advanced-design automation units and many completely automatic machine tools that are capable of producing seventy V-8 engines per hour at 100 per cent efficiency.

Cylinder blocks for the engines are processed on a 660-foot long, straight-line installation of four Ingersoll and three Greenlee transfer machines prior to assembly of the bearing caps. The continuous block line then makes a U-turn and continues for several hundred more feet to complete the assemblies. Automation units are provided to unload each machine, transfer the castings, and load the next machine. Also, at various stations on the transfer machines, the blocks are automatically inspected, and rotated or turned over to remove chips or position them for subsequent machining. Blocks for the two engines are machined on the same line, with selector units being provided at certain stations to load the blocks into either of two cylinder boring machines.

Prior to machining, the cylinder block castings are inspected with qualifying fixtures to check the amount of stock on the bank surfaces, cylinder bores, and end surfaces, as well as the positions of the main bearings. Then the blocks are automatically loaded, top side up and front end first, by means of a W. F. & John Barnes automation unit into the Ingersoll eleven-station transfer machine seen in the heading illustration. On this machine, four locating pads on each casting are milled, the blocks are rolled over 180 degrees by means of a turnover fixture so that their pan-rail faces are up, the half-crank bear-

Fig. 2. Loading end of the second of three transfer machines. They complete nearly all of the drilling, reaming, countersinking, chamfering, and tapping operations required on the V-8 engine cylinder blocks

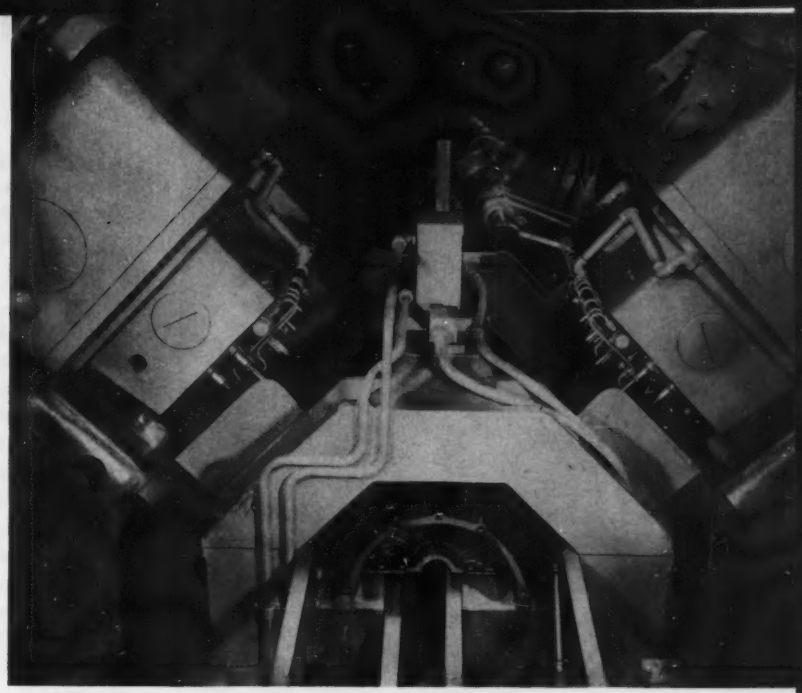

Fig. 3. Close-up view of eighth station on a fifteen-station transfer machine, showing the fifteen-spindle, left- and right-hand heads which are employed for tapping operations on blocks

ings are rough-bored, and the rear cam bearings are core-drilled.

Also, at the seventh and eighth stations on this machine, the pan-rail surfaces and bearing cap seats are rough- and finish-milled, and the bearing cap seats are broached to width. A shaving tool-holder carrying seven right- and seven left-hand tungsten-carbide broaching blades is employed for this operation. At the ninth station, two holes 3/4 inch in diameter, which are used for locating purposes throughout the remainder of the block machining, are drilled, chamfered, and reamed in the pan rail; eight holes are drilled in the bearing cap seats; and one hole alongside the No. 4 bearing cap seat is drilled and chamfered.

After automatic unloading, transferring, and reloading, the cylinder blocks pass through another Ingersoll eleven-station transfer machine. Here, the ends of the crank bearings are milled, the crank bearings are notched, 29 holes are drilled, and 33 holes are chamfered. A probing type inspection fixture is employed at the eighth station to automatically check the depth of the holes drilled in the pan rail and bearing cap seats.

On the third automatic transfer machine, which is an Ingersoll seven-station unit, the top and cylinder bank surfaces on the cast blocks are rough- and finish-milled. Up to this point, the same operations are performed on both engine blocks. However, at the sixth station, Fig. 1, a selector mechanism is provided to automatically feed the two sizes of blocks into the correct cylinder boring unit. One unit rough-bores some cylinders to a diameter of 3.770 inches, while the other unit rough-bores the remaining cylinders to a diameter of 3.958 inches. Subsequent operations are then performed on both blocks.

The fourth Ingersoll transfer machine contains sixteen stations for rough- and finish-milling the front ends of the blocks and the flywheel housings; rough- and finish-boring the oil-filler and distributor shaft holes; and rough- and finish-facing the distributor shaft holes. Also, left-hand, right-hand, and vertical heads are provided at subsequent stations for drilling, chamfering, counterboring, or reaming a total of twenty-eight holes in each block. Oil-gallery holes in the blocks are completed in three passes. At the thirteenth station, chips are blown out of the block by air blasts, and all holes in the ends are automatically inspected. The oil-gallery holes are air-tested for leaks at the fourteenth station, and unsatisfactory blocks are automatically ejected at the fifteenth.

A tool control board made by The Cross Company is provided for each transfer machine. The boards have calibrated indicators to show when the tools at each station on the transfer machine require changing. Tools are pre-set by means of the gages provided, and are stored on the boards to permit quick replacements.

On the first of three Greenlee transfer machines, an eighteen-station unit, a total of 56 oil-, mounting, tappet cover, and distributor shaft holes are drilled. Also six core-plug holes are rough- and finish-bored, eighteen holes are countersunk, six are chamfered, and ten are tapped. A Greenlee eighteen-station transfer machine, Fig. 2, is then employed to drill 125 holes, countersink 36, rough-bore 16, chamfer 16, ream 4, and tap 1 hole.

The third transfer machine, containing fifteen stations, is used to semi- and finish-ream 16

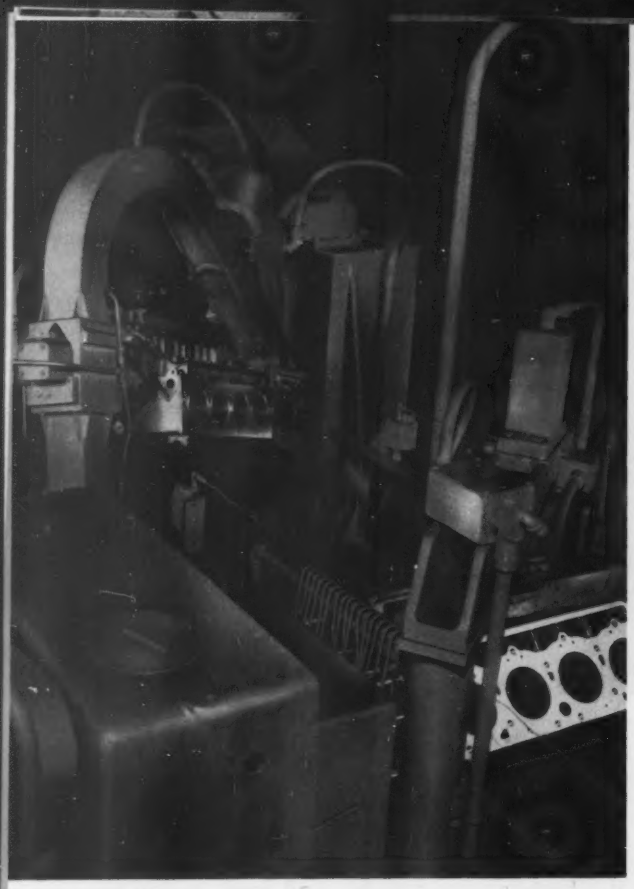

Fig. 4. Cylinder blocks are relocated 90 degrees in two directions simultaneously by means of this repositioning unit located on a transfer machine.

tappet holes, 0.905 inch in diameter, and tap 96 holes. In Fig. 3 is seen the eighth station on this machine, showing the fifteen-spindle, left- and right-hand tapping heads. A turnover fixture at the ninth station rotates the blocks 90 degrees so that their pan rails face the right-hand side of the machine.

A unique "half-twist" repositioning unit, Fig. 4, is employed on this Greenlee transfer machine to relocate the block 90 degrees in two directions simultaneously. This compound fixture rolls the block half over and also turns it from an endwise to crosswise position on the machine. The combination of this unit and the 90-degree turnover fixture at the ninth station permits the tools to work on the block from six directions.

Bearing caps are assembled to the blocks with bolts, using torque wrenches and hexagonal sockets. The assemblies are then automatically unloaded from a conveyor and loaded into an Ingersoll twelve-station transfer machine.

At the second and third stations of this transfer machine, the blocks are automatically inspected with a fixture to insure that there is sufficient clearance for the cam and crank boring heads, and blocks with insufficient clearance are rejected. The cam and crank bearings are rough- and semi-finish-bored, counterbored, and chamfered at subsequent stations. Also, oil slinger and oil-seal grooves are turned, and the thrust bearing is faced and chamfered on this machine. Because of the large amount of machining done, it was necessary to provide fixtures at the fifth, ninth, and eleventh stations to turn the blocks over and dump the chips. The cam bearings and angular oil lead holes are also blown out at the eleventh station.

On the next machine in the block line, an Ingersoll ten-station unit, the cam and crank bearings are finish-bored to size within 0.0005 inch, using solid tungsten-carbide tools mounted in a boring-bar. The bearings are inspected for size, taper, and out-of-round at the third station

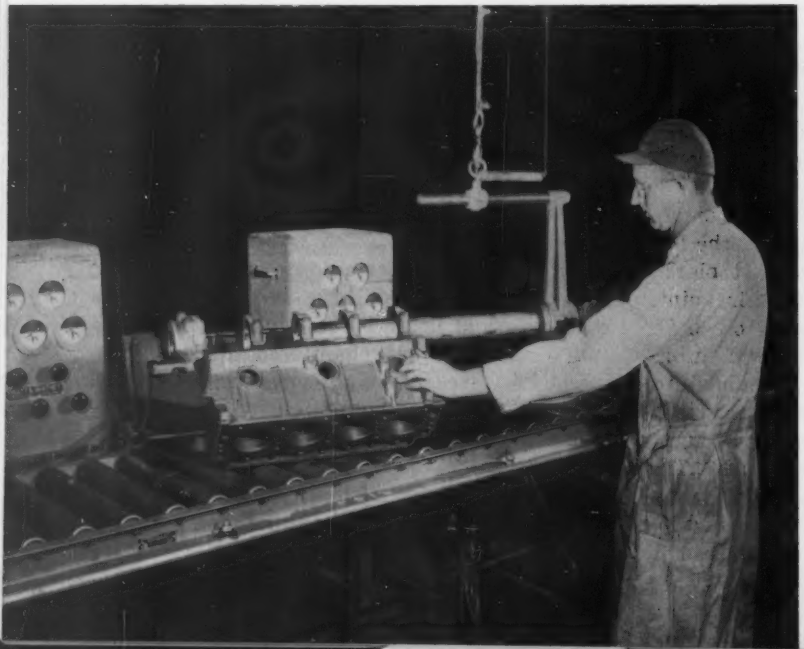

Fig. 5. Size, taper and out-of-round of cam and crank bearings in cylinder block are inspected at third station of transfer machine by means of five-station Air-O-Limit comparators. Sizes are held to 0.0005 inch.

of the transfer machine, by means of Pratt & Whitney five-station, Air-O-Limit comparators, Fig. 5. These gages are suspended from overhead counterbalances, and each has a long spindle with five pairs of diametrically opposed air orifices properly spaced along its length. Thus all five diameters are measured simultaneously and shown on individual dial indicators.

Distributor shaft holes in the cylinder blocks are finish-faced and bored, one hole in the rear end of each block is reamed, and the bank surfaces are finish-milled on the same machine. Also, at the sixth station, another selector unit is provided to automatically transfer blocks having 4-inch diameter cylinder bores from the main block machining line. These blocks pass through an Ingersoll four-station transfer machine where the top and bottom of each cylinder are chamfered, and the cylinders are semi-finish- and finish-bored. Then the cylinder bores are honed to a diameter between 3.9995 and 4.0015 inches, two bores at a time, on a Micromatic two-spindle Hydrohoner machine. These same operations are performed on the blocks having 3 13/16-inch diameter bores—except that the bores are honed eight at a time—by routing the blocks straight through the main line.

An Ingersoll eight-station transfer machine is then employed to automatically press the cam bearing babbitt liners in place, apply sealer in the core-plug holes, and press the core plugs in place. At the fifth station, the cylinder block assemblies are rubber sealed, submerged in water, and subjected to an air pressure of 50 pounds per square inch to test for leaks. Assemblies in which leaks are detected are ejected at the next station. Manufacturing lugs are milled off the blocks at the seventh station.

After assembling and bolting the flywheel covers to the engine blocks, the assemblies pass through two Natco three-station boring machines. Here the flywheel ends are rough-, semi-finish-, and finish-bored; faced; and chamfered. This completes the machining of the cylinder block assemblies, and their cylinder bore sizes are teletyped to the assembly area for selective fitting of pistons.

Cast cylinder heads for the V-8 engines are completed on a straight-line installation of four transfer machines. The first transfer machine, an Ingersoll twelve-station unit, is a departure from conventional practice in that the head surfaces are milled instead of broached. In succession, the top face, combustion chamber side, and both ends of the cylinder heads are rough- and finish-milled, the heads being rotated to the required positions between operations. Also, the intake and exhaust manifold pads, as well as the four combustion chambers in each head, are rough- and finish-milled; ten holes are drilled; two holes are chamfered; and four holes are reamed on this machine.

From the unloading station of the previous machine, the cylinder heads are automatically loaded, with exhaust sides up and combustion chambers toward the left, into a W. F. & John Barnes nineteen-station transfer machine, Fig. 6. Here, the four spark plug holes in each head are countersunk, drilled, reamed, and counterbored; and 78 other holes—including bolt, stud, push-rod, valve-cover, and water holes—in the joint and top faces of each head are drilled. Also, 9 holes are core-drilled, 12 are countersunk, 8 are bored, 2 are counterbored, and 14 are spot-faced. An interesting operation performed at both the eighth and eleventh stations is the trepanning

Fig. 6. Cylinder heads are automatically loaded into this nineteen-station transfer machine, in which ninety-one holes are drilled, and thirty-six other holes are countersunk, bored, counterbored, or spot-faced.

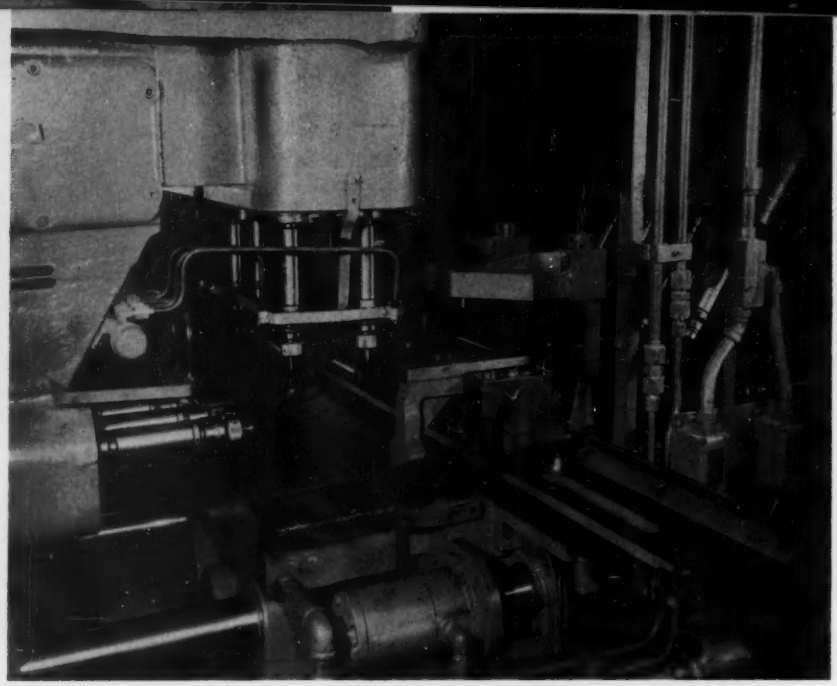

Fig. 7. At sixth station of an eighteen-station transfer machine, twenty-four taps mounted on left- and right-hand horizontal and vertical spindles thread various holes in cylinder heads.

of four valve spring seats, using special four-lip hollow milling cutters (tungsten carbide-tipped).

An eighteen-station transfer machine made by the W. F. & John Barnes Co. then completes the drilling and performs tapping operations on the cylinder heads. Left-hand, right-hand, and vertical heads provided at the various stations are tooled to drill a total of 20 holes, countersink 19 holes, and tap 32 holes. A typical multiple-tooling set-up is illustrated in a view of the sixth station, Fig. 7. At this station, 10 taps are mounted on the spindles of the left-hand horizontal and vertical heads, and 14 taps on the right-hand horizontal and vertical heads. Threaded at this station are six holes in the exhaust manifold face, four spark plug holes, six holes in the intake manifold face, seven valve cover mounting holes, and one water hole.

Pistons for the engines are aluminum-alloy, permanent mold castings. Ring lands on the cast piston are rough-turned, three-fourths of the dome end is faced, the No. 3 ring groove is rough-turned, the skirt is parted from the dome end, and the skirt end is faced to length and

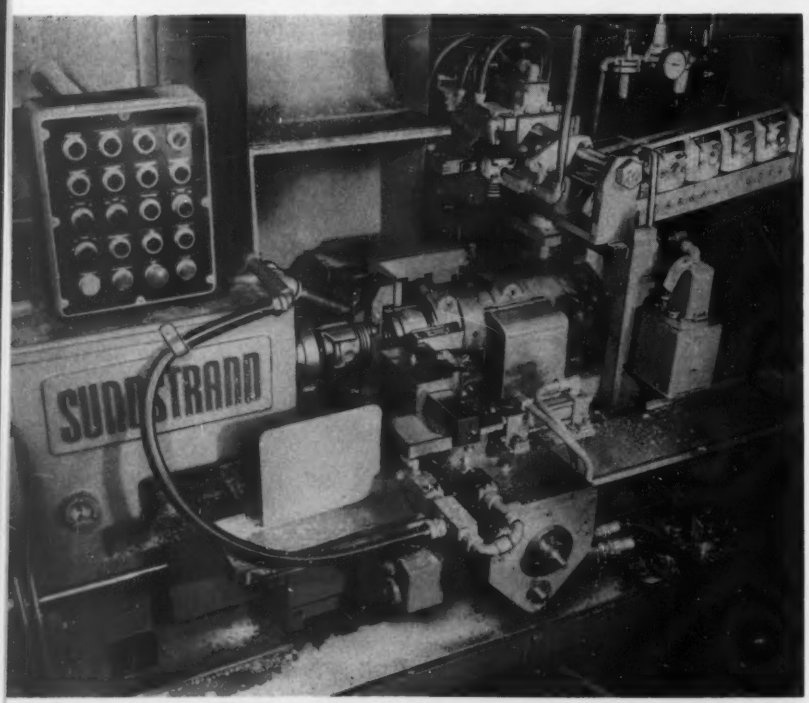

Fig. 8. Automatic lathe used to finish-turn ring lands, skirt, and ring grooves; face and chamfer dome end; and chamfer edges of grooves on the pistons

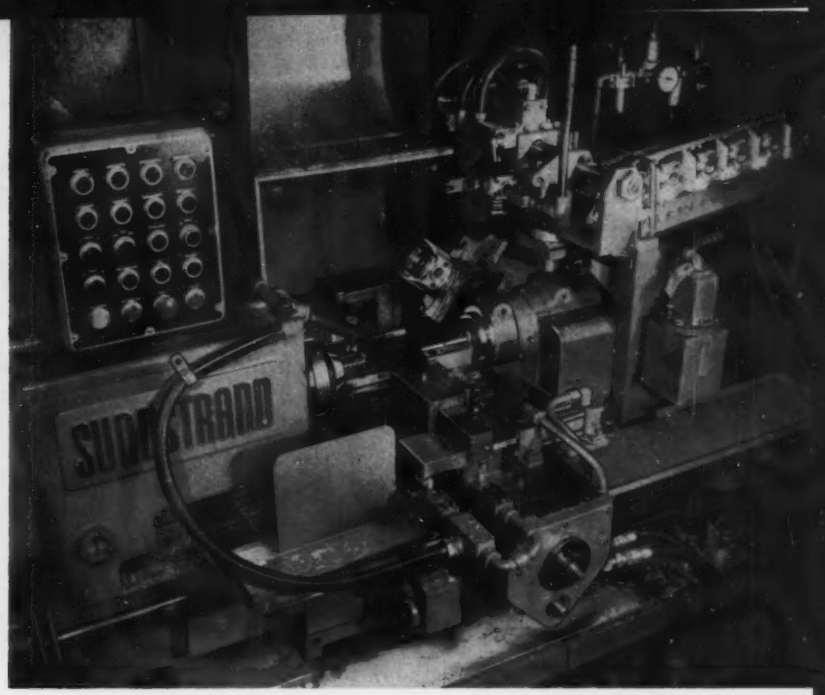

Fig. 9. Here, a machined piston is seen being removed from the automatic lathe by means of a swinging arm. The piston is ejected into a discharge chute, and another piston is lowered into position for machining.

chamfered on an Acme-Gridley multiple-spindle, automatic chucking machine. A four-station, trunnion type machine, made by the Hartford Special Machinery Co., is employed to rough- and semi-finish-bore and groove the pin-holes, center the dome end, and rough- and finish-face the weight bosses cast in the pistons. Eight smoke holes are drilled in the No. 3 ring grooves on an Edlund eight-spindle drilling machine.

Finish-machining of the piston is performed on the Sundstrand automatic stub lathe seen in Fig. 8. In this set-up, ring lands and the skirt are finish-turned, and the dome end is finish-faced and chamfered. Also, the ring grooves are rough- and finish-turned—maintaining their widths within plus or minus 0.0005 inch—and the edges of the grooves are chamfered.

Pistons are fed into loading position on the lathe by means of a magazine. A swinging arm picks up the pistons, one by one, and lowers them into the chucking position. After machining, the arm raises the piston, as seen in Fig. 9, and it is automatically ejected into a discharge chute in line with the loading magazine.

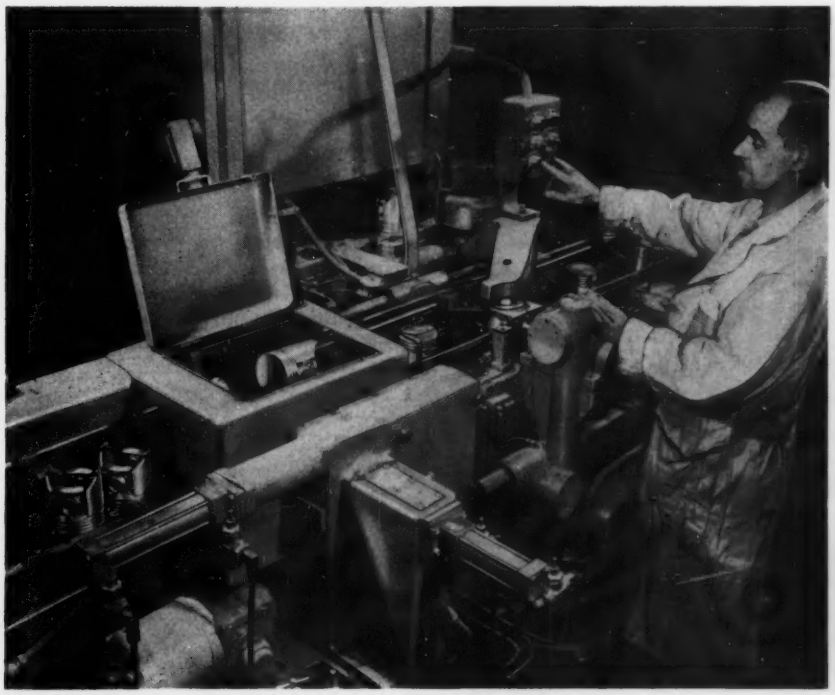

Fig. 10. Pistons are weight-balanced on this fully automatic transfer type machine. One scale pre-sets the milling cutters, and the second checks the pistons.

Peripheries of the piston skirts are ground to an elliptical cross-section on a Norton semi-automatic piston grinding machine. This plunge type grinder has a cam-generating mechanism that gives the piston the motion necessary to obtain the required form. After deburring, washing with petroleum solvents, and drying the pistons, they are weight-balanced on a Morris automatic piston balancing machine, Fig. 10.

Pistons are automatically loaded into the balancing machine. Rotation of the pistons is automatically stopped in the required position, and the pistons are automatically turned upside down and pass over a scale that pre-sets the milling cutters for the amount of stock to be removed from the weight bosses. After milling, the weight of the pistons is checked on a second scale. If the pistons are over or under the prescribed weight limits, the machine will automatically stop.

Pin-holes in the pistons are finish-bored to a diameter of 0.9804 inch, plus or minus 0.0002 inch, on an Ex-Cell-O single-end, three-spindle precision boring machine, Fig. 11. Three pistons are bored at a time. Automation devices have been provided for automatic loading and unloading. In the machine, the piston is located between centers and radially from the semi-finished pin-holes, and clamped against its dome end. As the pistons are unloaded, their pin-holes are automatically inspected by means of Sheffield air gages, as seen in Fig. 12.

From the discharge chute of the precision boring machine, the pistons are self-loading on a conveyor. While on the conveyor, the pistons are successively washed, dried, deburred by soft-grit blasting, blown off, and tin-plated. A Pratt & Whitney multiple-station, combination Electro-limit and Air-O-Limit inspection machine is used to check the various dimensions of the pistons. This machine also classifies the pistons according to their skirt diameters, and prints the classification on the piston heads for subsequent use in selective assembly with the cylinder blocks.

Crankshaft bearing caps are cast in blocks, each block containing a cluster of five caps that is cut apart after machining. Only two machines are employed to completely finish the bearing caps. The first machine to be used is a Lapointe 50-ton, 120-inch stroke, surface broaching machine, Fig. 13. Top, sides, and joint surfaces of the bearing cap blocks are rough- and finish-broached, and the half-round bearing surfaces are rough- and semi-finish-broached on this horizontal, single-ram machine. Broaching is performed on both the forward and reverse strokes of the ram, which travels at 172 feet per minute. The machine is equipped with an electromechanical drive that permits broaching at speeds up to 300 feet per minute.

Machining of the crankshaft bearing cap blocks is completed on a Kearney & Trecker twelve-station transfer machine. After automatic loading of the blocks, a groove and an end surface are planetary milled to provide accurate locating at subsequent stations. Right- and left-

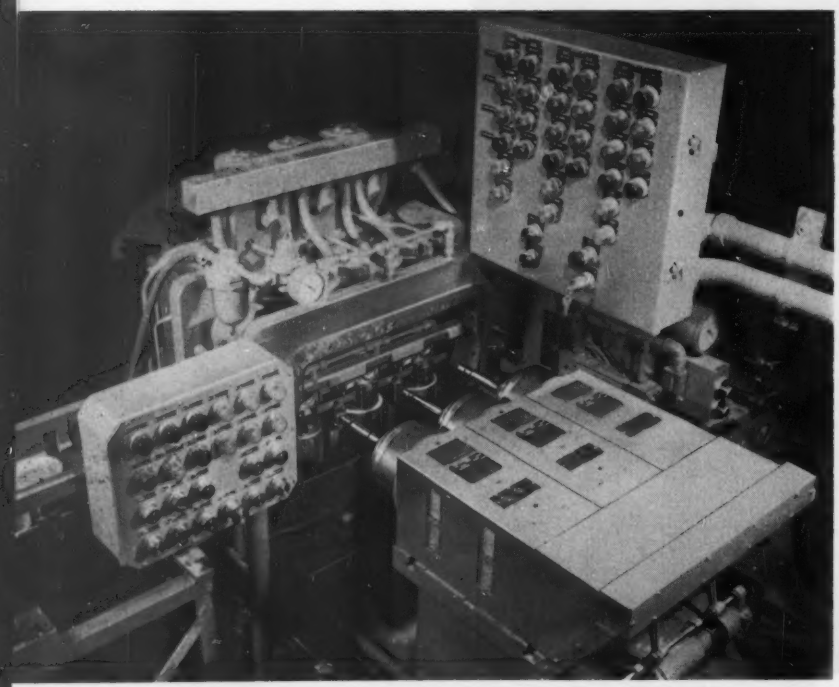

Fig. 11. Single-end precision boring machine for finishing pin-holes in three pistons at a time. Holes are bored to within plus or minus 0.0002 inch of the required size.

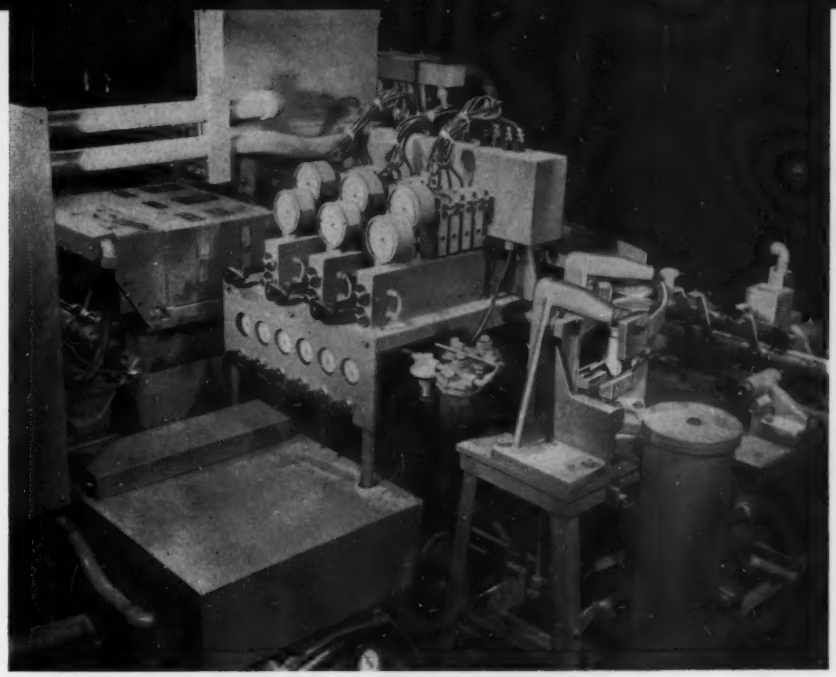

Fig. 12. Air gages are employed at the unloading end of the boring machine seen in Fig. 11 to automatically inspect the sizes of the pinholes in the pistons.

hand heads at the third and fourth stations are tooled to drill fifteen holes and countersink one hole. Probing pins are provided on a right-hand head fixture at the fifth station to check ten previously drilled bolt holes. The left-hand head at the same station carries tools to spot-face four bolt holes and countersink one oil-hole.

Eleven holes are reamed, four are spot-faced, and the depth of two previously drilled oil-pump bracket holes are checked at the sixth station. The probing pins are drilled to permit blowing out the bracket holes with air blasts. These two holes, 0.688 inch deep, are tapped with 0.375–12 threads at the seventh station. The eighth station is idle, and five bearing lock notches are milled with slotting cutters, which are 2 1/2 inches in diameter by 0.188 inch wide, mounted on an arbor at the ninth station. Also, a left-hand angular head at the same station drills a 0.500-inch diameter hole. After passing through another idle station, the blocks are milled to an over-all length of 8.653 inches, and cut off to form five individual caps from each block. Width of the No. 1 cap is 1.078 inches; the Nos. 2, 3, and 4 caps are 1.125 inches wide; and the No. 5 cap is 2.889 inches wide.

Fig. 13. Top, sides, and joint and half-round bearing surfaces of cast bearing cap blocks are broached on this 50-ton, 120-inch stroke, single-ram, horizontal broaching machine.

Keeping 20,000 Gallons of Cutting Oil Clean

National Cash Register Co. faced a serious problem caused by gumming of cutting oil serving approximately 800 machine tools. Now, gumming has been eliminated, tool life increased, product quality improved, and production boosted by means of a low-cost, highly efficient purification system here described

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CUTTING oils represent a substantial investment to most metal-working companies. In addition to the cost of the oils themselves, they strongly influence the required expenditures for cutting tools, the quality of work produced, the rate and cost of production, and the health of the machine operators. Unless impurities are removed, the cutting oils become contaminated and cannot properly perform their lubricating and cooling functions.

At the Dayton, Ohio, plant of the National Cash Register Co., a central cutting oil system contains an estimated 20,000 gallons of oil. Approximately 1200 gallons of oil are drawn from the system per eight-hour shift for use in about 800 machine tools, including 550 single- and multiple-spindle automatic screw machines. On the screw machines alone, approximately 6,000,000 parts are produced in two forty-hour shifts weekly.

Chips from these machines are wrung to remove excess oil, and the oil is successively passed through four 500-gallon tanks. Since insufficient foreign material was being removed in settling, a filtering system was installed to clear the oil of harmful matter. Also, a steam-heating coil was provided to aid in the filtration of the oil.

Even with these provisions, the oil was gumming and frequent shutdowns were neces-

sary to clean the clogged screens of the machine reservoirs. Investigations showed that the steam-heating coil was not maintaining a constant oil temperature—the temperature rising and falling periodically between 110 and 240 degrees F. during an eight-hour shift. Since high temperatures are known to cause rapid oxidation of this type oil, it was felt that excessive heating was breaking down the oil, and the coil was removed.

After heating was discontinued, the filters clogged much more rapidly and required cleaning approximately every fifteen minutes (compared with the previous eight-hour periods without cleaning). Such frequent cleaning was seriously interfering with production requirements and raising costs.

Continued investigation showed that a trial addition of 3 per cent butyl carbitol in one machine tended to remove deposited sludge and reduce clogging of the screen. Accordingly, during the annual summer shutdown of the plant, the cutting oil system was drained and cleaned. Then, 3 per cent of butyl carbitol was added to the oil returned to the system, and 10 per cent to the make-up oil used for replacement. In all, 500 gallons of this material was added. Subsequent inspection, however, showed that clogging of the screens and gumming of the machines had not decreased.

A very fine sludge was observed to settle from the cutting oil when the machines were allowed to stand over week ends. An oil-free sample of this sludge proved, on analysis, to be partly metal particles from cutting operations and partly a dark brown, gummy substance. This gum was found to be readily soluble in plating lacquer thinner, and was thought to be the result of oil oxidation or breakdown.

The use of filters of various types was given careful consideration. However, no filter appeared adequate for the removal of this material. In considering other means of clarifying the oil, it was concluded that centrifuging was most suitable for this application. As a result of investigating various centrifuges, a tubular bowl type centrifugal cutting oil purifier was installed in the central system, next to the settling tanks. Oil is drawn into the centrifuge from the third settling tank, and clarified oil is discharged into the fourth tank.

With this set-up, the problem of cutting oil gumming has been effectively solved. Foreign material is removed from the oil, the rate of oil oxidation is reduced, and the precipitation of sludge on the machines is eliminated. Also, longer tool life and improved surface finish on the parts produced have been obtained.

A moderately sulphurized, fatty mineral oil having a viscosity of 250 seconds Saybolt Universal at 100 degrees F. is employed in the central system at National Cash Register. For six weeks after the centrifuge was installed,

Fig. 1. Centrifugal wringers for spinning oil from chips. Operator at left is placing a basket filled with oil-soaked chips into a wringer.

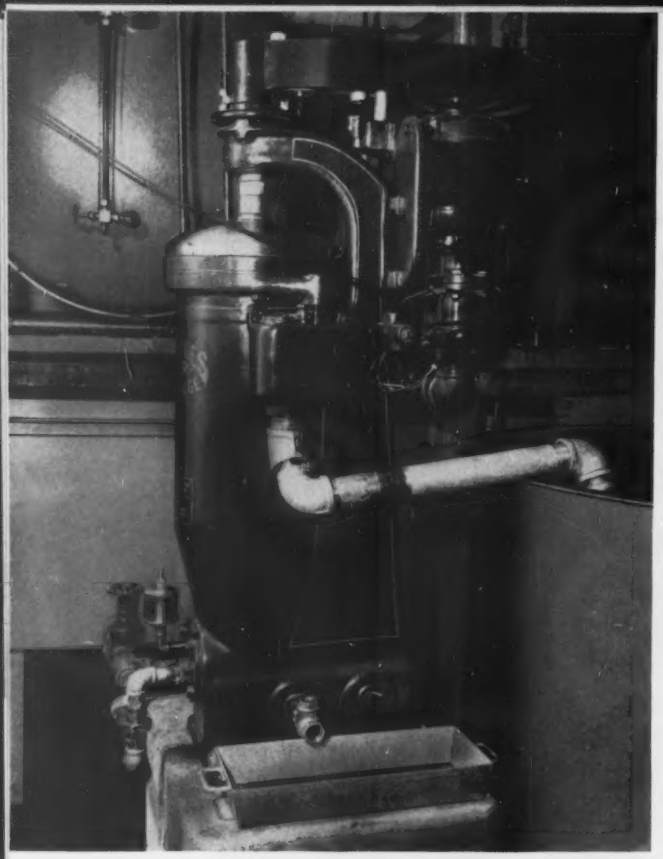


Fig. 2. Contaminated oil from third settling tank is continuously pumped into centrifugal oil purifier, which revolves at 15,000 R.P.M.

continued tests and careful analyses were made to determine the practicality of the unit. Quart samples of the oil were taken both before and after centrifuging and tested to determine the viscosity; sulphur and fat content; and amount of sludge, metal, and water suspended in the oil.

Recovered material was divided into three groups: (1) soluble in petroleum distillate; (2) insoluble in petroleum distillate but soluble in plating lacquer thinner; and (3) insoluble in either solvent. Portions of the samples that were soluble in petroleum distillate (about 20 per cent of the sludge) were of a heavy nature, and were believed to be oil that had oxidized and polymerized to some extent. The material soluble in plating lacquer thinner (approximately 35 per cent of the sludge removed) was a resinous material, closely resembling lacquer or shellac. It was assumed that this material was oil that had oxidized and polymerized more completely. This material is a major part of the gum on the machines, and acts as a binder for chips on the screens.

The insoluble material consists largely of metal particles, mostly steel, but includes appreciable amounts of other dirt. The samples indicated an average sludge analysis of 55 per cent oxidized oil; 15 per cent water; 25 per cent metal; 1.5 per cent wood (sawdust), lint, or dust; and 3.5 per cent sand. Thus, the 7 pounds of sludge obtained every eight hours contains approximately 3 3/4 pounds of oxidized oil; 1 pound of water; 1 3/4 pounds of metal; 1/8 pound of lint, wood, or dust; and 1/4 pound of sand.

Centrifuging decreases the amount of sludge in the oil from 0.25 to 0.06 per cent—a reduction of 76 per cent. Although there was no significant difference in the viscosity of the "before" and "after" samples, there was an indication that the viscosity of the oil had decreased approximately 10 seconds Saybolt Universal at 100 degrees F. in the six-week test period. This lowering of the viscosity was probably due either to a decrease in the sludge content of the oil or to a change in the nature of the sludge.

Analysis of the samples of oil taken before and after centrifuging showed a decrease of 74 per cent in the oxidized oil content; 96 per cent in

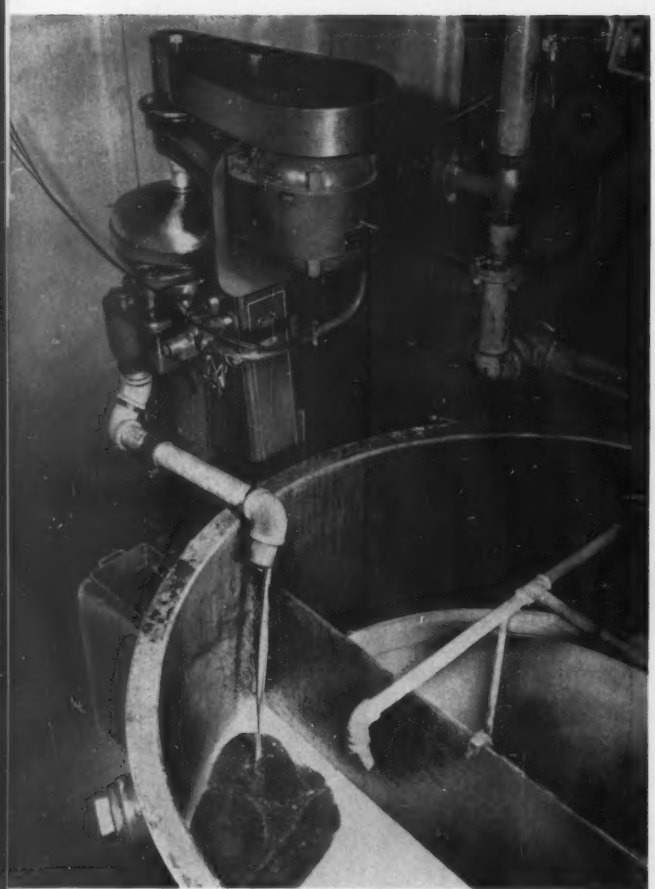


Fig. 3. Purified oil from the centrifuge is discharged into a fourth tank, from which it is pumped into a closed storage tank.

the metal, wood, and sand content; and 100 per cent in the water content. Removal of the oxidized oil eliminates precipitation of sludge on the machines; removal of the metal and sand improves tool life and surface finish produced; and removal of the water reduces the rate of oil oxidation.

As the cutting oil system is now set up, oil-soaked chips are collected from the various machine tools in tubs, and are brought to a centrally located room where they are placed in baskets. These baskets are placed in centrifugal wringers, Fig. 1, which spin the oil off the chips. Dirty cutting oil from the wringers flows down a pipe into the first of four 500-gallon tanks, as seen in the heading illustration. Large particles of foreign material settle out in this tank or the two subsequent tanks into which the oil overflows.

A vertical dividing baffle in each tank, over which the oil must flow, increases the settling action. The settling tanks are cleaned twice a year, and sludge to a depth of about 18 inches is removed from the first tank at each cleaning. A carbon dioxide system is provided above the tanks for fire control.

From the third settling tank, the contaminated oil is continuously pumped at a pressure of 5 pounds per square inch into the bottom of the centrifugal oil purifier, Fig. 2, through a hollow boss. The centrifuge bowl is essentially a cylinder containing a "three-wing" insert, both of which revolve at 15,000 R.P.M. When filled with oil, the heavier solids and liquids are separated from the relatively lighter oil by centrifugal force. The separating force generated is equivalent to 13,200 times the force of gravity.

The rotating cylinder or bowl, 30 inches long and having an inside diameter of 4 inches, is suspended from a motor- and belt-driven flexible spindle. The lower end of the bowl is supported by a loosely fitting guide bushing which is cushion-mounted so that the dynamically balanced bowl rotates smoothly around its true center of mass. A paper lining rolled to fit the bowl prevents the cake of foreign matter that is formed from adhering to the inner surface of the bowl, and facilitates removal of the sludge. This paper lining is held in place by the "three-wing" insert, 2 feet long, which also serves to insure positive rotation of the oil. The insert is pushed against the top end of the bowl, leaving a 6-inch space at the bottom to allow the oil to approach the speed of the bowl gradually.

The continuous flow of contaminated oil into the bottom of the bowl displaces oil upward. Centrifugal force causes the solid particles to be deposited and held against the paper lining. Also, any water present is deposited with the sludge against the wall of the bowl. Purified oil, being of lighter weight than the water and sludge, forms an inner layer in the bowl and is discharged continuously from ports at the top of the bowl.

Although this particular size centrifuge has a rated capacity of 400 gallons per hour, a flow of 150 gallons per hour is sufficient to meet the requirement for 1200 gallons of cutting oil per eight-hour day. Flow is controlled by a valve on the feed pipe from the third tank. The purified oil is discharged into the fourth tank, Fig. 3, and from there it is pumped under a pressure of 50 pounds per square inch into a closed storage tank. Outlet pipes from the storage tank lead to filling stations in the automatic screw machine and other departments, where operators draw off the oil as required. At the filling station, the purified oil is directed into hand tubs, as can be seen in Fig. 4. The tubs are carried to the sumps of the various machines, as required, by means of a portable hand truck.

Fig. 4. Filling stations, connected to purified oil tank, are provided at convenient locations, such as this one in automatic department.

Fig. 5. (Left) Centrifuge bowl is taken from centrifugal oil purifier and placed in a special vise on a bench top for cleaning every eight hours.

Fig. 6. (Right) Here the sludge cake has been pulled from the centrifuge bowl and slit lengthwise. Three-wing insert is seen on top of sludge cake.

The centrifuge is cleaned after eight hours of operation, and lubricated every four hours. It takes one man from ten to twenty minutes for the cleaning operation and another ten for the lubricating. In cleaning, Fig. 5, the centrifuge bowl is placed in a special vise and the bottom cap is removed with a wrench. An extension sleeve is screwed on the bottom of the bowl and struck on a wood block to loosen the sludge in the bowl, the sludge cake dropping to the bottom of the extension sleeve.

The centrifuge bowl is replaced in the vise, the extension sleeve unscrewed, and the sludge cake pulled out with a twisting motion. After slitting the cake lengthwise, Fig. 6, the three-wing insert is removed and cleaned with a spatula. The sludge cake varies from 5/8 to 7/8 inch thick at the bottom, to 3/8 to 1/2 inch thick at the top, and weighs from 5 to 8 pounds—which is 2 to 3.5 grams of sludge per gallon of oil clarified. The bowl, too, is cleaned with a brush, and, if necessary, all three bowl parts are washed in trichlorethylene to remove gum deposits. Thorough cleaning is essential, since a small amount of unremoved sludge could cause serious unbalance of the bowl in subsequent operation.

After cleaning the bowl and insert, a cylinder is formed from paper, and this liner is placed in the bowl and smoothed against its bore. With the three-wing insert replaced and the cap screwed to the bowl bottom, the assembly is mounted in the centrifuge. In operation, slowdown of the rotating element is accomplished by means of a brake conveniently located in the side of the frame.

The use of this equipment has improved the over-all operation of the machining departments serviced by this system. Although the nature of these improvements is such that actual financial savings cannot be evaluated, it is obvious that the values obtained warrant the continued operation of the unit.

Compact Transfer Machine Drills and Taps Typewriter Castings

"Power frames" for electric typewriters are now completed on a transfer machine in a small fraction of the time previously required by individual drilling methods. Intervals for inspection purposes are included in the cycle of operation so that a detailed final inspection is practically eliminated

By Raymond H. Spiotta
Assistant Editor

INCREASED output of electric typewriters at the Poughkeepsie, N. Y., plant of the International Business Machines Corporation gave rise to the need of altering existing production methods. An outstanding example of the effectiveness of such an alteration on the manufacture of one particular part will here be described.

One of the main chassis units of the electric typewriter is an intricately shaped aluminum die-casting, Fig. 1, known as a "power frame." Upon the dimensional accuracy of this particular member rests, to a great extent, the performance quality of the typewriter. Therefore, great care is exercised during machining.

Due to the high quality of the die-casting, only three milling operations are required. All of them precede drilling. In the first operation, one part is located at a time in a fixture on a Brown & Sharpe horizontal milling machine, Fig. 2, and locked in place by three sets of air-actuated clamping fingers. Then, while the work is fed at the rate of 35 inches per minute, two 4-inch diameter carbide-tipped side milling cutters, rotating at a speed of 1050 R.P.M., straddle-mill a pair of rail seats located on the upper surface of the casting. These seats serve as locating surfaces in future operations.

The second milling operation is performed on a Sundstrand duplex Rigidmil. After being se-

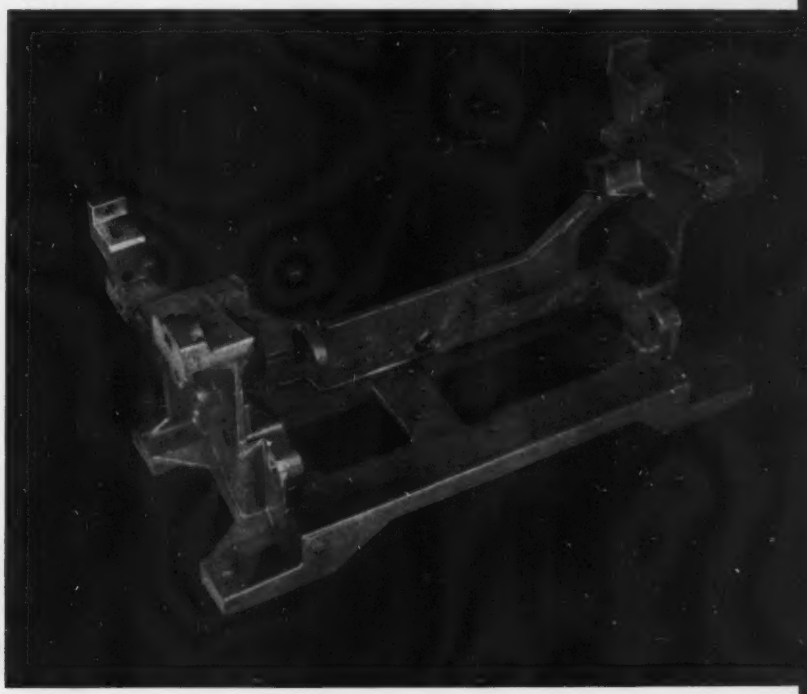


Fig. 1. When the machine is fully loaded with twenty-four pallets, a total of fifty-six holes are drilled and tapped in each of two "power frames" every fifty seconds. The die-casting is a vital component of I.B.M.'s electric typewriters.

cured in a fixture by means of air clamps, the mounting lugs on both ends of the casting are machined simultaneously. Two 6-inch diameter carbide face mills rotating at a speed of 1400 R.P.M. are used. The casting is fed past the cutters at a rate of 37 inches per minute.

Final machining is done on a second Sundstrand duplex milling machine. In this operation, all remaining end pads and bosses that are not in the same plane as the mounting lugs just finished, are milled. High-speed steel helical end-mills, 3/4 inch in diameter, do the cutting.

The next step, which is drilling and tapping, was the one that proved to be a major bottleneck. Three 18-spindle multiple drill head machines were set up for drilling only. Each power frame was loaded into an individual jig and placed on the table of the first drill press, where the required holes were drilled. Then the entire jig, which weighed 85 pounds, had to be passed to the second operator for additional drilling, and subsequently, to the third.

After a number of castings had been drilled, the set-up was torn down and then set up for tapping. Total "down" time for the change-over was twenty-four hours. Following completion of the tapping operation, the parts were transported to a nearby washer where cutting oil and chips were removed. Peak production of this part required around-the-clock operation of the drill press crews.

Elimination of this expensive stumbling block from the path of efficient production was accomplished by the installation of a Zagar twenty-six-station automatic transfer machine, Fig. 3. This compact unit is designed to provide a rectangular flow pattern with the loading and unloading stations adjacent to one another. Each part travels the full 93-foot length of the machine; the two longer sides having an individual length of 28 feet, and the two shorter sides, an individual length of 18 1/2 feet.

In its course of travel, a total of 105 spindles drill, tap, counterbore, and ream 56 holes in each power frame. Also included in the transfer machine is a washing station where shavings and chips are removed. Following washing, the parts, now completed, arrive at the unloading station.

Two castings are placed in each fixture, or "pallet," at the loading station. The operation may be seen in the upper right-hand portion of Fig. 3. When the parts are properly banked on their previously machined rail seats, two clamping leaves are swung into position. Thumbscrews, by means of which the castings are locked in place, are carefully tightened with a torque wrench to insure identical positioning of each part, regardless of differences in the "feel" of various operators.

After loading the pallet, the operator moves it along a short length of conveyor roller to the first corner of the rectangular transfer machine. From this point the pallet starts its automatic journey. When the work moves into the first station, four pins rise from the tracks and enter four bushings in the corners of the pallet. This serves to locate the fixture in the correct position for drilling.

The pins are interlocked with the electrical system of the entire machine. Should the pallet be out of position and the pins be unable to seat within the bushings, the machine will stop. This precaution is necessary to prevent the pallets that follow from piling up. The operator is immediately notified if such a condition occurs by a system of warning lights on a master control panel. In this way he can see at a glance which station is jammed, and can rectify the situation with a minimum of lost time.

Fig. 2. Straddle-milling two rail seats which are to serve as locating surfaces. The casting is rigidly supported in a fixture employing three sets of air-actuated clamping fingers for holding purposes.

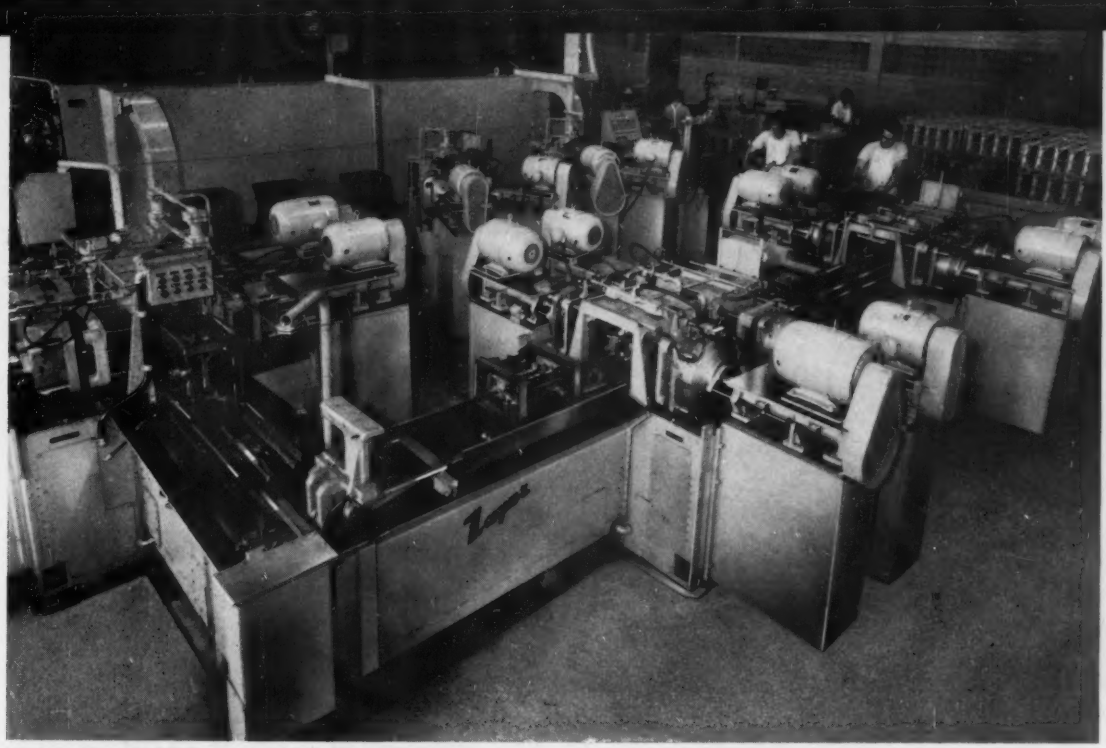


Fig. 3. Twenty-six-station automatic transfer machine, designed for drilling and tapping an aluminum typewriter component. An overhead cable serves as an emergency shut-off device.

Another safety feature consists of an overhead cable extending around the three working sides of the machine. This serves as an emergency cord. If any malfunction or other dangerous situation arises, the entire machine can be shut down immediately by pulling the cord.

At the first station, two opposed Zagar gearless drill heads feed into the work, drilling sixteen holes in the ends of each casting. When the heads retract, the locating pins disengage the pallet and it moves to the second working station. Here the locating sequence is repeated and two more drill heads tap eleven holes in the ends of each work-piece.

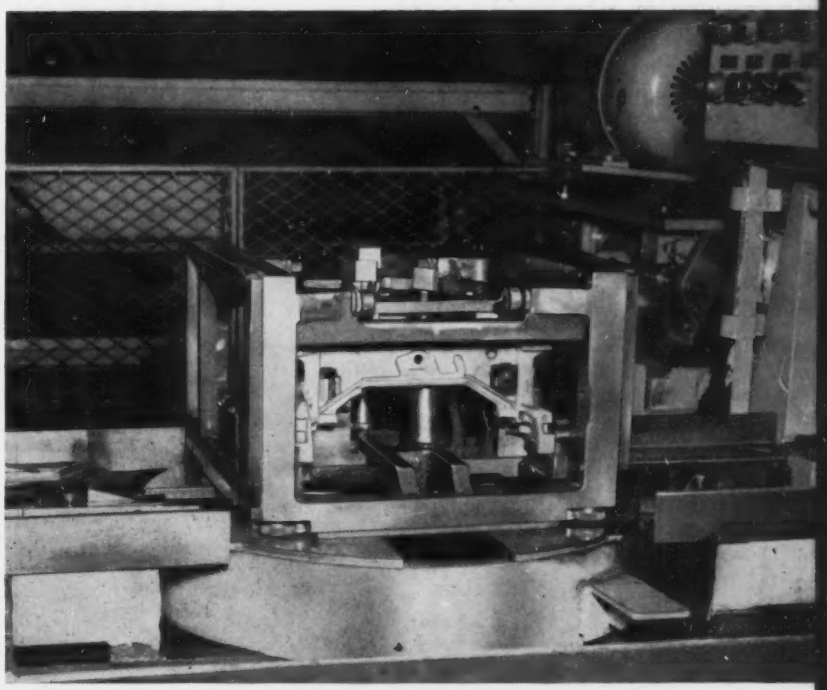


Fig. 4. After the ends of the parts have been drilled, a pick-up arm pulls the pallet onto a turntable, where it is rotated 90 degrees. This brings the rear faces of the work into position.

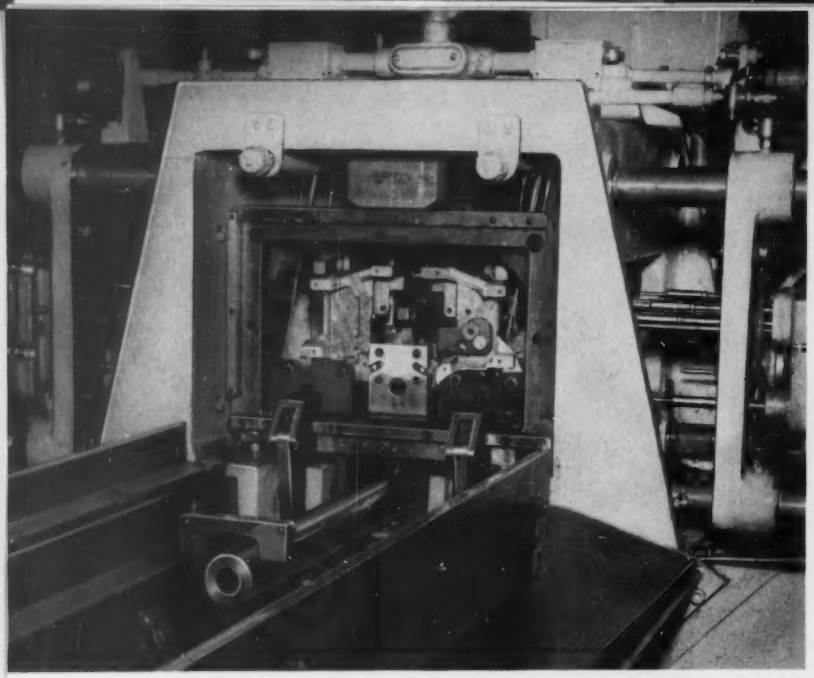


Fig. 5. Clamps pivot from beneath the tracks and lock the pallet firmly in place. Locating is accomplished by means of pins that rise up and enter bushings in the corners of the fixture.

A pick-up arm engages the pallet from beneath and pulls it to a turntable, Fig. 4. As the arm returns to its original position, it contacts the table, which then rotates 90 degrees. This exposes the back faces of the two power frames for the next drilling operation.

In the upper right-hand corner of Fig. 4 may be seen a small control panel. Each work station is provided with its own control system. This arrangement permits the independent cycling of any station without making it necessary to energize the remaining sections of the machine. It is particularly convenient in the event of a local breakdown or in setting up one station at a time.

After being rotated on the turntable, the pallet is pulled into the next work station. Four pins locate the work in the same manner, while clamps swing up from below and lock the ends of the pallet. A total of twenty holes are drilled in the rear face of each work-piece, following which the clamps are released.

Moving to the next station, the pallet is located and clamped, Fig. 5. Thirteen holes are tapped in each part. The locating pins, bushings, and the hold-down clamps are clearly shown.

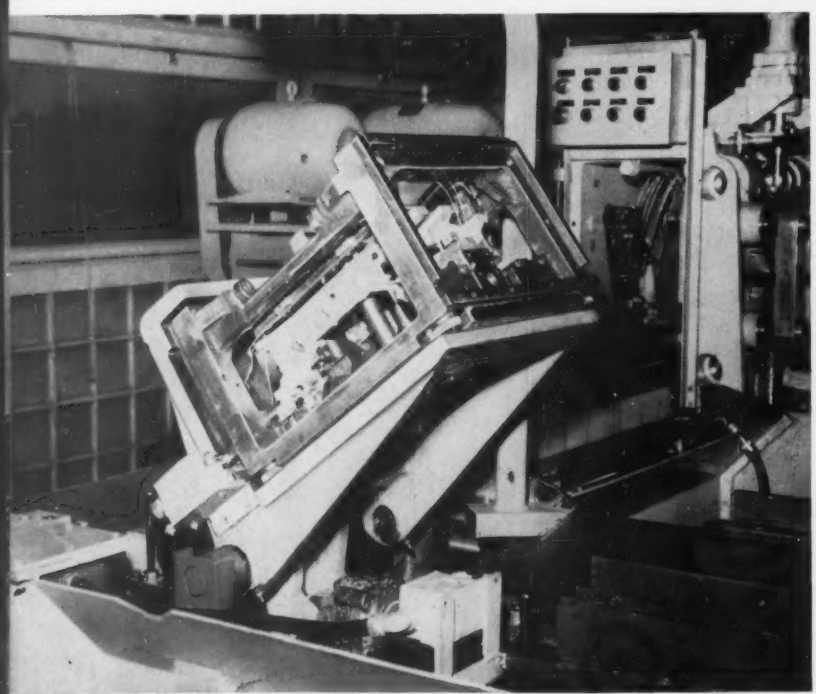


Fig. 6. A pallet is seated in a hydraulically actuated cradle which rolls it into a vertical position. This allows the upper and lower surfaces to be brought into the drilling plane.

Fig. 7. After drilling and tapping the upper and lower surfaces, the pallet emerges from a work station. Overhead coolant headers direct copious quantities of the fluid over the work surfaces.

Also illustrated are two coolant headers that continuously spray the fluid on the work surface. An independent system supplies filtered coolant to all work stations.

At the end of the first long side of the transfer machine is a roll-over mechanism. The pallet is seated in a hydraulically actuated cradle, Fig. 6, where it is rolled up on its end. In the background may be seen the entrance to the next work station. Locating bushings are also provided in the end of the pallet. They allow the same locating procedure to be used in the stations in which the parts are to be drilled in a vertical position.

There are two working stations on the short side of the machine. In the first station, fifteen holes are drilled in the upper and lower surfaces of the casting. In the second station, Fig. 7, twelve of these holes are tapped.

As the pallet reaches the end of this short side, it is fed onto another turntable. The table rotates 90 degrees, from which point the pallet starts its trip down the second long side of the transfer machine. By rotating the fixture a quarter-turn at this corner, the upper and lower surfaces of the work that have just been drilled are in the same positions with respect to the next work station.

The following two stations complete the drilling and tapping of the castings. At the first one, two angularly placed gearless drill heads feed in and drill all the holes located on the inclined surfaces of the work-piece. These holes are then tapped at the second station.

When the pallet reaches the last corner of the machine, it is rolled over to its original position. A plunger then pushes it onto a ledge over the wash tank. The ledge moves up and down in the tank, thoroughly removing chips and other foreign matter from the castings. Clean coolant is used as the washing medium. After cleaning, the pallet is transferred to the unloading station. Unloading is done at the rate of two power frames every fifty seconds, or approximately 144 per hour.

There are many inspection stations throughout the cycle of operation. These stations consist of intervals along the line in which roving inspection can be carried out. By maintaining an efficient inspection system during operation of the transfer machine, detailed final inspection can be materially reduced.

* * *

Electronic Thickness Gages for Metallic Coatings

The National Bureau of Standards has recently developed three types of instruments for measuring the thickness of electrodeposited coatings. Although all three instruments depend upon the difference in electrical conductivity between the plating and the base metal, each makes use of different methods for sensing specimen resistance.

Two of the instruments, an electronic thickness gage called the "Dermitron" and a phase-angle thickness meter, utilize electromagnetic coupling to the specimen, making use of the reflected field from eddy currents induced in the specimen. The third, a wave-guide plating quantity indicator, employs direct conductivity measurement with pointed electrodes. All three devices permit simple non-destructive determination of either plating or sample thickness for homogeneous metals.

Second and concluding installment of an article describing some of the outstanding automation equipment and machines employed in producing parts for Pontiac's new V-8 engine

Modern Tooling Produces Pontiac's New V-8 Engine

By Buel E. Starr
General Manufacturing Manager, Pontiac Motor Division
General Motors Corporation, Pontiac, Mich.

OUTSTANDING processes and interesting equipment used in manufacturing engine blocks, cylinder heads, connecting-rods, and bearing caps for Pontiac's new Strato-Streak V-8 engine were described in the first installment of this article, published in November, 1954, MACHINERY, page 160. The production of crankshafts, camshafts, pistons, sprockets, and flywheel housings will be described in this concluding installment.

Crankshafts start as 80-pound steel forgings, are approximately 26 inches long, and weigh 58 pounds after machining. Automatic handling of these heavy parts is important, not only to increase production but also to prevent operator fatigue.

Both ends of each crankshaft are center-drilled, and six driving spots are milled on their counterweights on four-station Sundstrand centering and milling machines, such as

the one seen in Fig. 15. The forgings are manually loaded at the first station by means of overhead balancing hoists. After being automatically transferred to the second station, both ends of the shaft are center-drilled. At the third station, the shaft is supported between headstock and tailstock centers, and six milling cutters—each containing ten inserted carbide-tipped blades—cut the driving spots on the counterweights. The crankshafts are automatically unloaded at the fourth station and transferred to Wickes automatic center-drive lathes.

These lathes are automatically loaded and unloaded, as seen in Fig. 16, by means of overhead traversing hoists on the front of the machines. A centered and milled crankshaft is lifted from the inclined storage rack at the right, located between headstock and tailstock centers in the center-drive chuck, and clamped. A total of twenty-five high-speed steel tool bits are mounted on three sets of cross-slides (front, rear, and top) for rough- and finish-turning and facing the five main bearings, sprockets, flange, and oil-seal surface on each crankshaft. When the machining cycle has been completed, the crankshaft is automatically unloaded and placed on the storage rack at the left. With this set-up, one operator can attend more than one crankshaft lathe.

The outside diameters of the five main bearings, oil-seal surface, and pilot diameter of the crankshaft are rough-ground on Landis multiple-wheel grinding machines, each equipped with six grinding wheels that are initially 42 inches in diameter. Approximately 0.026 inch of stock is removed from the various surfaces. Pin bearings are rough- and finish-turned, and adjoining cheek surfaces are faced, on LeBlond two-spindle pin lathes. By rough- and finish-turning the pin bearings, only 0.025 inch of stock has to be removed from their diameters in subsequent grinding.

Oil-holes are drilled in the crankshafts on Krueger-Barnes nineteen-station transfer machines. All holes are drilled to depth in two passes (with the exception of one hole which requires three passes) as the crankshafts are automatically transferred from station to station on rails. The first pass in each oil-hole is made with a drill 0.250 inch in diameter, and the second pass, with a drill 0.246 inch in diameter. An automatic inspection machine is provided on the transfer machine to check the depth of the drilled holes. If any of the required holes have not been drilled, or are not drilled to the specified depth, the machine will automatically stop.

Automatic transfer from the unloading station of the drilling machine to a lathe made by the Crankshaft Machine Co., is accomplished with a walking-beam transfer mechanism that is called the "rolling stairway." From the top of this stairway, the crankshafts are automatically loaded into the lathe for turning and chamfering the counterweights. At the completion of the cycle, the crankshaft is automatically unloaded and transferred to an Impco machine for straightening the shaft and peening the oil-holes.

Oil-seal and pilot surfaces, and the five main bearings on each crankshaft are finish-ground on Landis multiple-wheel grinding machines, such as the one seen in Fig. 17. The seven surfaces are finished with six grinding wheels, one of the wheels being wider and gashed to grind two adjoining surfaces. The shaft is supported between hydraulically actuated headstock and

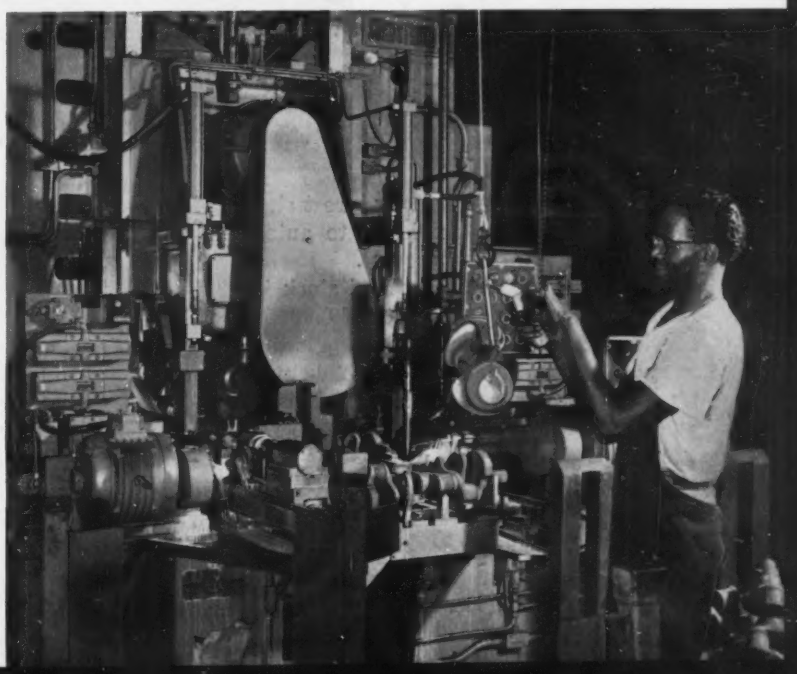


Fig. 15. Both ends of the crankshaft are center-drilled, and six driving spots are milled on their counterweights, on this four-station machine

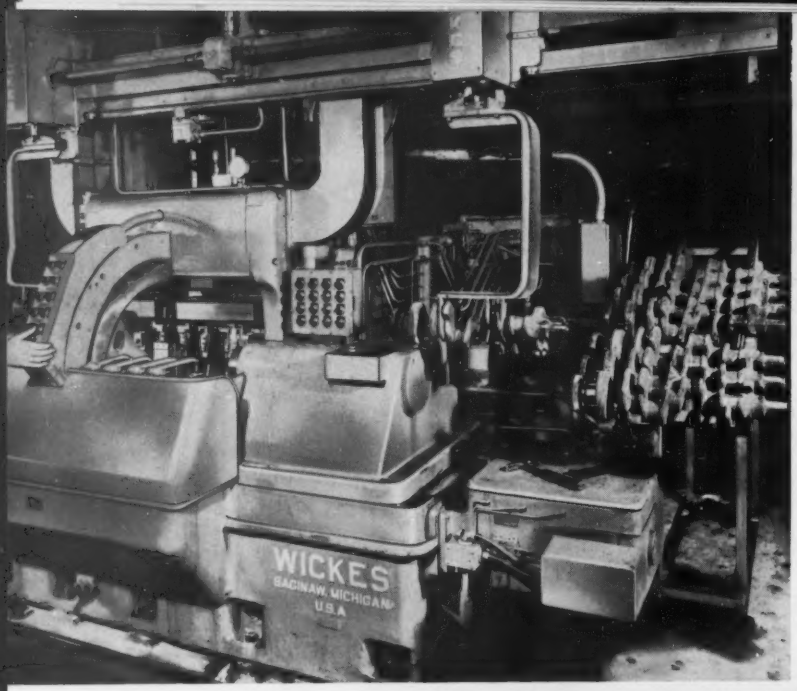


Fig. 16. (Left) Automatic loading and unloading are outstanding features of this center-drive crankshaft lathe. An operator can attend more than one of these machines

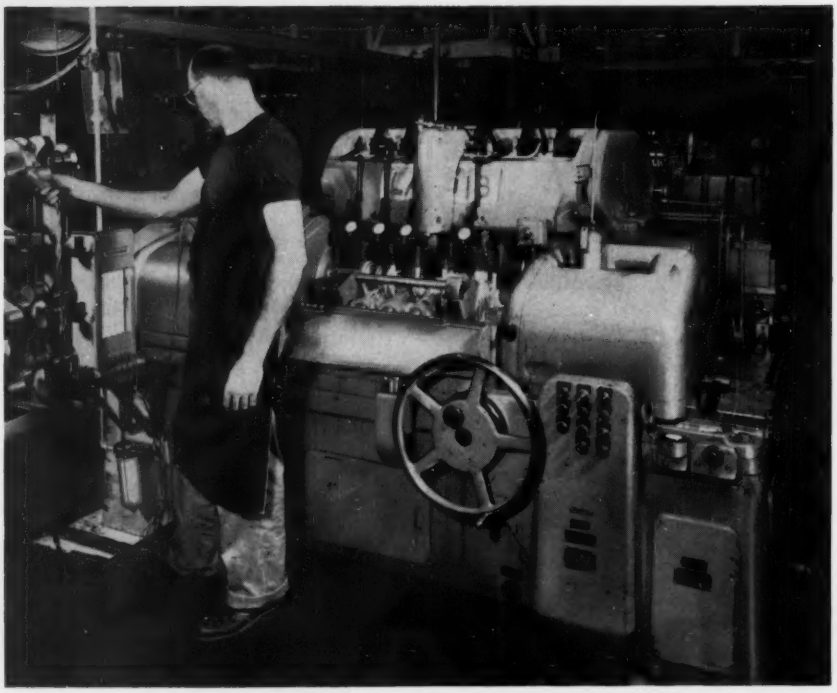


Fig. 17. (Right) Multiple-wheel grinding machine for finishing the oil-seal and pilot surfaces, and the five main bearings on each crankshaft

tailstock centers, and by steadyrest shoes. Dial-indicator gages are employed to automatically size the surfaces being ground.

Approximately 0.020 inch of stock is ground from each surface at the rate of 0.0005 inch per revolution. Surface speed of the grinding wheels is maintained at about 6500 feet per minute by increasing their rotational speed as their diameters are decreased by wear. The wheels are dressed after grinding about thirty crankshafts, using diamond dressers and Citco hydraulic turners that shift the position of the diamonds after each dressing to prolong diamond life. Main-bearing diameters are held to size within 0.0005 inch, while out-of-roundness and taper are maintained within 0.00025 inch.

Ends of the crankshafts are drilled, reamed, and tapped, and a keyway is milled in each shaft on Baker special double-end, ten-station, rotary indexing machines. Crankshafts are dynamically balanced on Gisholt Dynetric two-element machines. When the amount and location of the dynamic unbalance have been determined, the crankshaft is automatically transferred to a correction drilling unit electrically connected to the machine. The depths to which four 1 3/8-

inch diameter drills are fed into the crankshaft are automatically set by the unbalance measuring machine. While one crankshaft is being drilled, another is being balanced. In this way, one man can balance sixty crankshafts per hour.

Pilot-bearing holes are bored, and flanges on the crankshafts are faced and chamfered, on Ex-Cell-O two-station transfer machines, Fig. 18. When the shafts have been clamped in special chucks, the rough-boring and facing heads and finish-boring bars are rotated to provide a cutting speed of 638 feet per minute in facing the maximum flange diameter which is 4 1/2 inches, and 368 feet per minute in boring. Carbide-tipped tool bits are employed for boring, facing, and flanging. The pilot-bearing holes are bored to size within plus or minus 0.0005 inch, and a production of 128 crankshafts per hour is obtained from each machine.

After grinding the pin bearings, both the pin and main bearings, as well as the oil-seal surface, are polished on Impco polishing machines equipped with 320 grit, aluminum-oxide abrasive belts. While a surface finish of 20 to 25 micro-inches r.m.s. is produced on these surfaces by grinding, the polishing operation smooths the surfaces to 8 micro-inches r.m.s. A Sheffield gaging machine is employed for final inspection of thirty-seven dimensions on each crankshaft.

Camshafts Completely Turned on Two Lathes

Cast camshafts for the V-8 engines are completely turned on two pairs of Lo-swing lathes that have been provided with automation equipment for loading and unloading both machines, transferring the shafts between machines, and inspecting all machined surfaces. On the first machine, two bearings and a sprocket on the shaft are turned, faced, and chamfered, and the front end is chamfered. As the camshaft is automatically transferred to the second machine, it is swung through an angle of 180 degrees in a horizontal plane. In the second machine, three bearings and a gear blank on the shaft are turned and faced, and the rear end is chamfered.

The loading and unloading work-carriers, having fingers for gripping the camshafts during transfer, are actuated by followers engaging a drum cam on top of each machine, as seen in Fig. 19. During machining, the camshafts are held between centers and driven by chuck jaws. Reloading time is only nine seconds, and the machining cycle for each machine is thirty seconds. At the completion of each cycle, the camshaft is raised by an air-operated elevator into a gaging unit, shown at the left center. The gages are electrically operated and connected to signal lamps which indicate whether the camshaft dimensions are within tolerances, or over size or under size. The machine stops automatically when an over- or under-size shaft has been produced.

Ends of the camshafts are drilled, reamed, and tapped, oil-holes are drilled, and a keyway is milled in each shaft, on a Buhr eight-station, double-end trunnion machine. The shafts are recentered on a Lo-swing automatic centering machine, and the five bearing surfaces are finished on Landis multiple-wheel grinding machines. After grinding the sprocket peripheries, thrust faces, and cam contours, a gear is cut on each camshaft with a Lees-Bradner six-spindle rotary hobbing machine. These gears are heat-treated on a Cincinnati flame-hardening

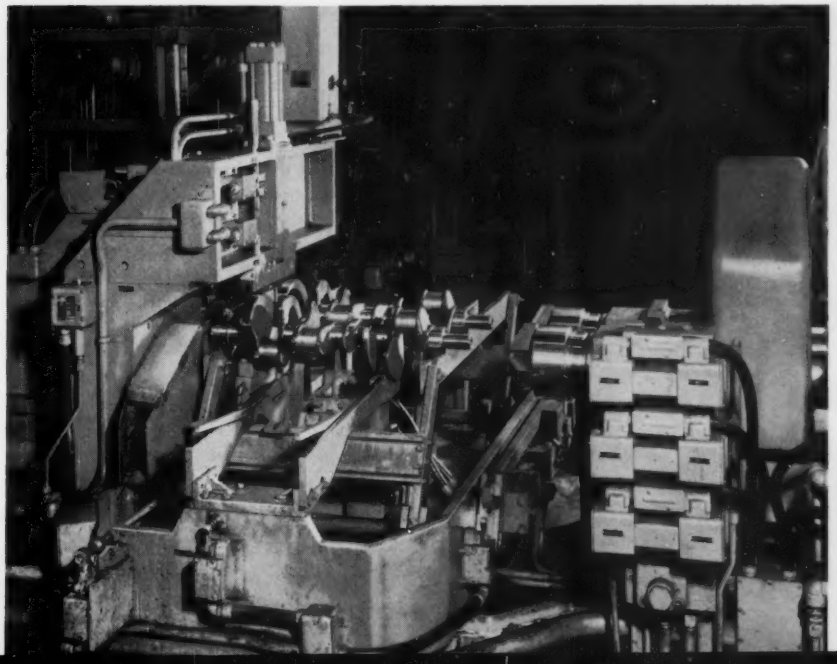


Fig. 18. Pilot-bearing holes are bored to within plus or minus 0.0005 inch, and flanges on the crankshafts are faced and chamfered on this two-station transfer machine

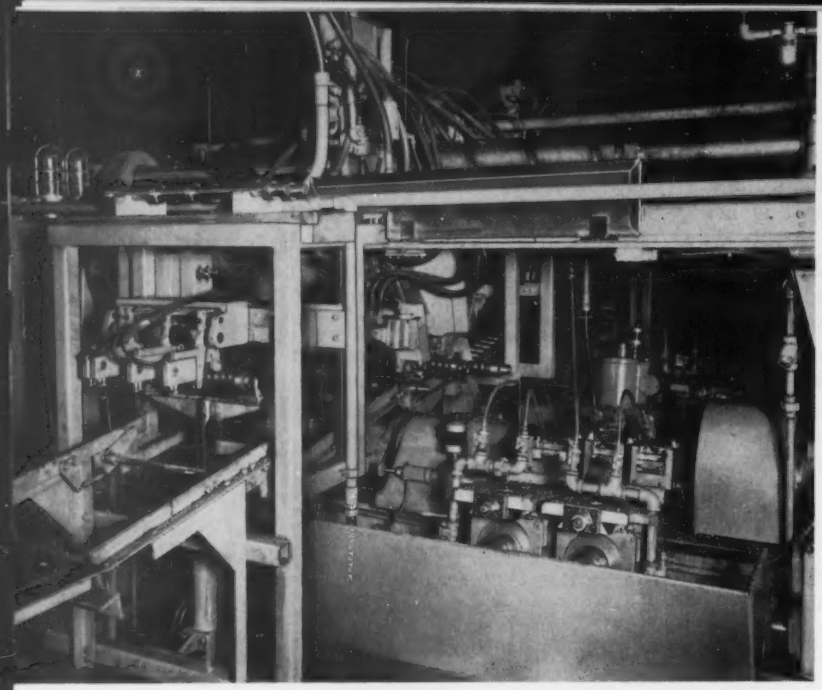


Fig. 19. Two lathes, provided with automatic loading, unloading, transferring, and inspecting equipment, employed for turning, facing, and chamfering V-8 engine camshafts

machine. The camshafts are then chemically treated in a Hanson-Van Winkle-Munning Lubrite system to impart a black, non-metallic oil-absorbent coating on their surfaces that reduces wear. After polishing the bearing surfaces on Impco machines and washing, the camshafts are ready for assembly in the engines.

Quality control is stressed in the production of pistons for the V-8 engine by providing automatic inspection devices after practically every machining operation. Here, too, maximum use is made of automation.

Approximately 50 per cent of the machining required on the cast-aluminum pistons is performed on Hoern & Dilts eight-station rotary indexing machines, such as the one seen in Fig. 20. Pistons are machined two at a time, each station on the rotary indexing table having two air-operated work-holding chucks. The pistons are automatically loaded into the chucks from magazines. At successive stations, the following operations are performed: weight pads cast on the pistons are traverse-milled; pin-holes are bored; two 5/16-inch diameter holes in the weight pads are drilled, chamfered, and reamed; retainer ring grooves in the pin-holes are cut; and the pin-holes are chamfered.

The pistons are automatically unloaded at the eighth station and transferred to Acme-Gridley eight-spindle, automatic chucking machines. These machines, too, are automatically loaded. At successive stations, piston ring grooves are slotted; ring lands and the piston skirts are finish-turned; the domes are finish-

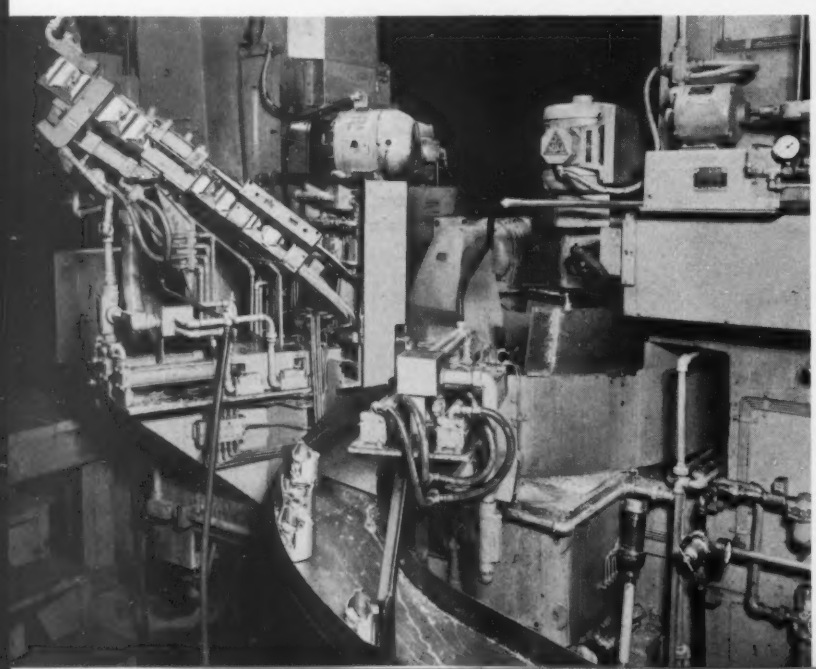


Fig. 20. Rotary indexing, eight-station machine completes approximately 50 per cent of machining required on pistons. Pistons are magazine fed and automatically unloaded

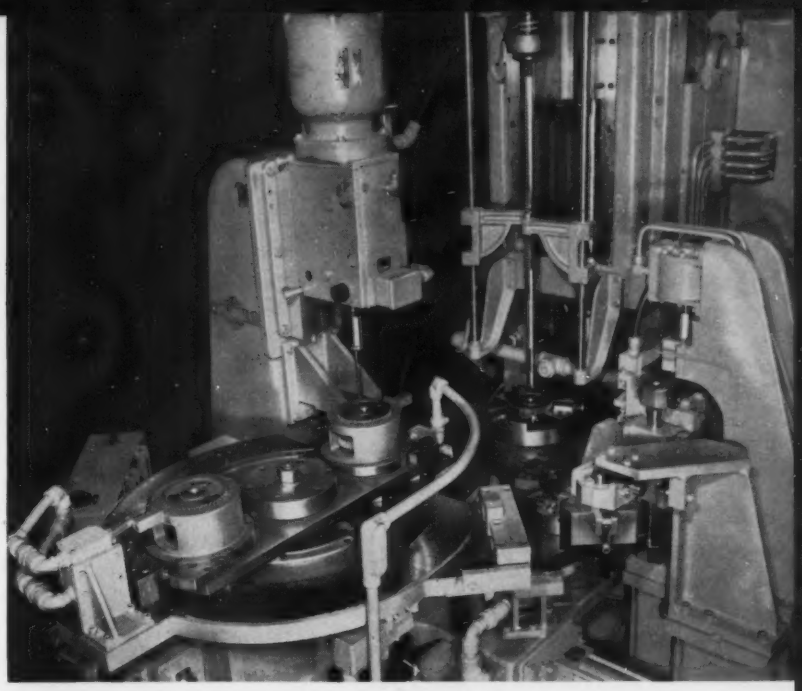


Fig. 21. Rotary indexing machine progressively drills a fuel pump eccentric hole, broaches a keyway, and stamps a timing mark in camshaft sprockets at a production rate of 200 an hour

faced; ends of the skirts are rough-grooved and faced; the head, grooves, slot, and end of the skirt are chamfered; and the No. 3 ring land is turned, and the grooves are roughed and finished.

After automatic unloading, the pistons pass through a Sheffield gaging machine that will indicate by lights which of the preceding machines is producing unacceptable pistons. Oil-holes, 0.156 inch in diameter, are drilled in the pistons on Buhr twelve-spindle drilling machines. After passing through another Sheffield gaging unit, the pistons are elliptically ground on Landis automatic grinding machines. Twelve of these grinders have been provided, but each machine will be set up to produce pistons varying slightly in diameter. Information teletyped from the assembly area with regard to cylinder bore sizes will be used to decide which grinders will be placed in production at any one time. Thus, the assembly line will be kept supplied with pistons of the required diameter.

Pistons are weight-balanced within plus or minus 1/16 ounce on Morris straight-through, transfer type milling machines, each equipped with two scales—one for pre-setting the milling cutters and the other for controlling the machine by checking the milled pistons. After tin-plating the pistons, their pin-holes are finish-bored to a diameter between 0.9801 and 0.9805 inch on Ex-Cell-O single-end boring machines, and "Bearingized" on Hesco four-spindle horizontal machines.

Cast-iron camshaft sprockets are faced,

Fig. 22. Two-station, radial head surface grinding machine for finishing engine, front, and pan faces of flywheel housings. Each station has three work-holding fixtures

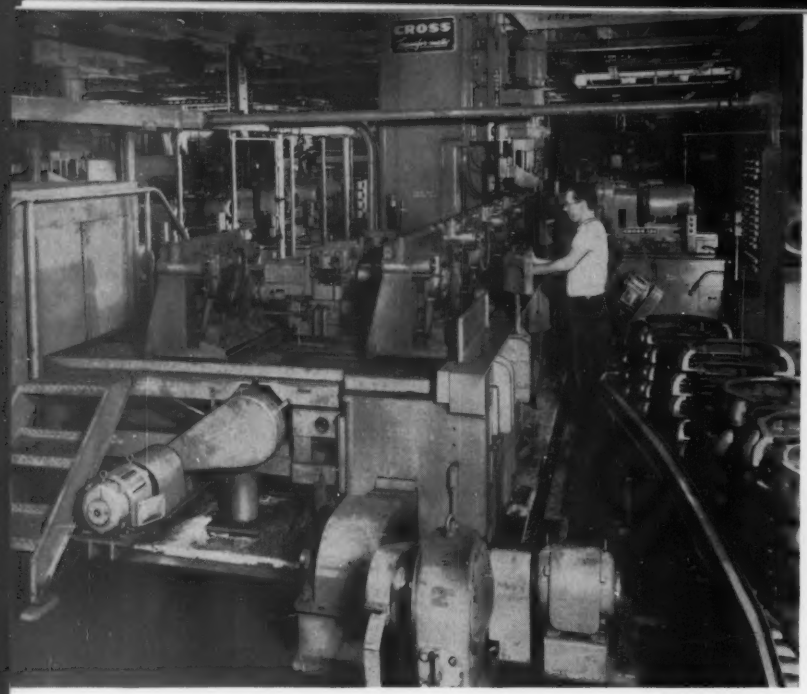


Fig. 23. Milling, drilling, countersinking, boring, chamfering, and tapping of the flywheel housing castings are completed on this eighteen-station automatic transfer machine

turned, drilled, formed, milled, spot-faced, and chamfered in two chuckings on an eight-spindle, double-indexing Conomatic. After hobbing the gear teeth, the sprockets are automatically loaded into an unusual machine, Fig. 21, which combines drilling, broaching, and stamping operations in one automatic cycle. This three-station machine, made by the Colonial Broach Co., is equipped with an automatic loading magazine and fixture, a rotary indexing table, and an unloading fixture.

The rotary indexing table is located off center and below the loading fixture. Sprockets in the magazine are loaded six at a time into circular holders, one on each end of an oscillating loading arm. Each holder contains an escapement mechanism which allows the sprockets to drop singly into one of four chucks on the rotary indexing table. When the sixth sprocket has dropped from the holder, the arm is automatically swung 180 degrees to position the empty holder under the loading magazine. The full holder on the opposite end of the arm then begins discharging sprockets into the chucks.

When a sprocket has been indexed to the first machining station, a Kingsbury cam-fed drilling unit equipped with a 0.2656-inch diameter drill cuts the fuel pump eccentric hole to a depth of 0.200 inch in the web. At the second machining station, a keyway 0.1885 by 0.1905 inch is broached in the sprocket bore by means of a Colonial pull-down broaching unit. A timing mark is stamped on each sprocket at the third machining station, and the sprockets are auto-

Fig. 24. Tool control board has indicators to show when tools at the various stations should be changed. Gages and fixtures are provided for pre-setting the tools

matically unloaded on a conveyor by hydraulically actuated fingers at the fourth station. Four holes are provided in the rotary table to allow the broaching tool to be returned following its working stroke, and the table is indexed 45 degrees each time. A production of 200 sprockets per hour is obtained from the machine.

Production of Cast-Iron Flywheel Housings

The engine, front, and pan faces on each cast-iron flywheel housing are ground in seventy-two seconds on Besly-Bowen radial head surface grinding machines, such as shown in Fig. 22. The machines have two stations, each consisting of a rotary table carrying three pneumatic clamping fixtures. On each fixture, a different face of the flywheel housing is presented to the inserted abrasive wheel, which is 26 inches in diameter. Thus, a completely ground casting is produced with every cycle of the machine.

While three parts are being automatically ground at one station, the operator is unloading and reloading at the other station. Approximately 3/32 inch of stock is ground from each surface, holding parallelism within 0.003 inch, flatness to 0.005 inch, and size within 0.010 inch.

Ground flywheel housing castings are manually clamped to pallets which are automatically transferred from station to station on the Cross rectangular track, eighteen-station Transfermatic seen in Fig. 23. All of the milling, drilling, countersinking, boring, chamfering, and tapping operations required on the flywheel housings are completed in this automatic machine. Typical of the tool control boards employed with this and other transfer machines in the V-8 engine plant is the one shown in Fig. 24. The boards are equipped with indicators (electrically connected to the machines) to show when the tools at each station require changing, and gages and fixtures for pre-setting the tools to minimize machine "down" time.

Every engine assembly—containing all rotating and reciprocating masses, such as pistons, rods, and bearings assembled in the engine block—is dynamically balanced within 1/2 inch-ounce at each end of the crankshaft on Gisholt Dynetric balancing machines, Fig. 25. After being automatically loaded into the balancing machine from an overhead conveyor, the engine crankshaft is coupled to the driveshaft of the machine and rotated at 425 R.P.M.

Angularity of the engine unbalance in indicated on a dial and manually transferred to a memory unit. The amount of unbalance is determined by flicking a switch and "zeroing out" another dial indicator. This information is automatically transferred through a selsyn motor and generator to pre-set the depth to which an unbalance correction drill will be fed. This cycle is repeated for the opposite end of the engine, and crankshaft rotation is stopped.

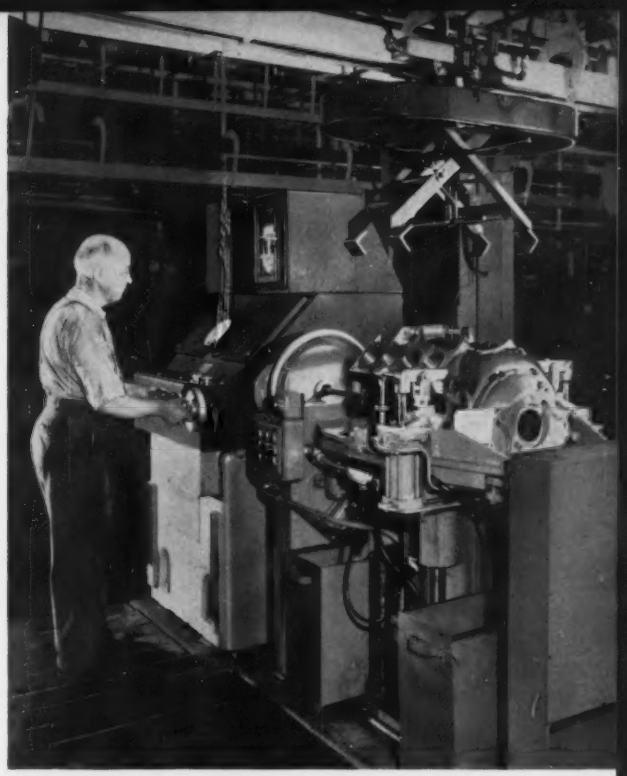
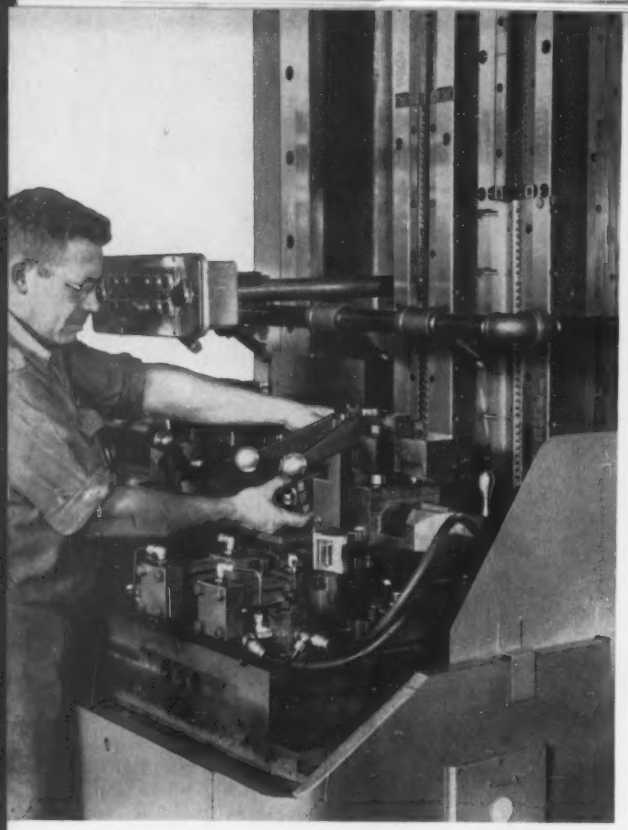


Fig. 25. Set-up for dynamically balancing engine assemblies containing all rotating and reciprocating elements. Unbalance is held to 1/2 inch-ounce at each end of crankshaft

When the crankshaft has been indexed to the setting on the memory unit, the drill unit is energized and the correct amount of stock removed from a counterweight on the crankshaft, no calculations being required by the operator. This cycle is repeated for the opposite end of the engine. The 15/16-inch diameter drills have a combination hydraulic-pneumatic feed. Chips formed in drilling are blown by air blasts into chutes that are formed to fit the crankshaft counterweights. After drilling both ends, the engine is re-run to check the effectiveness of the unbalance-correction drilling. Uncoupling of the crankshaft starts the automatic unloading cycle, which transfers the engine to an overhead conveyor. One operator can balance thirty engine assemblies per hour with this set-up.

Completely assembled engines are run for twenty minutes to check for water or oil leaks, and to detect any uneven, rough, noisy, or improper operation, on merry-go-round units such as the one seen in the heading illustration. Two of the rotary units, made by the Control Engineering Co., are employed, each unit containing twenty-three test stands.



Broaching Jet-Engine Blades at 120 Feet per Minute

Blades are held by matrix metal in steel blocks for accurate location during the broaching operations

THE highlight of a press conference recently held by the Detroit Broach Co. at its new plant in Rochester, Mich., was the demonstration of a 15-ton, dual-ram, vertical broaching machine tooled up for finishing the ends of Stellite blades for jet engines. This machine was run at a speed of 120 feet per minute, resulting in a production rate of 500 operations per hour.

Accurate location of the blades in this broaching operation is insured by previously assembling them in blocks of the type shown in Fig. 1. This is accomplished in the plant of the broaching machine user by employing a fixture in which the locating block and an unfinished jet-engine blade are accurately positioned in the desired relation to each other. Then a fast-cooling matrix metal is poured into the block to hold the blade securely to the block for the broaching. Later, the blade is removed by simply heating the assembly to a comparatively low temperature, sufficient to melt the matrix metal.

The block in the center of Fig. 1 has an unfinished blade. The block at the left has a blade on which the Christmas tree end has been broached, while the block at the right has a blade on which the shroud end has been broached. In the heading illustration, the operator is seen en-

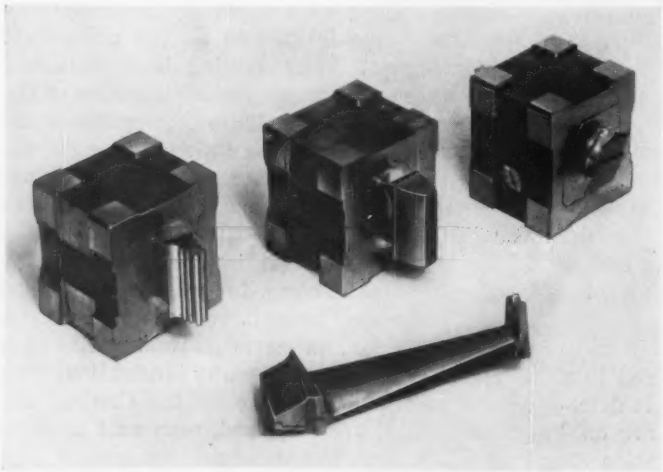


Fig. 1. Locating blocks in which blades for jet engines are held by matrix metal to insure accuracy of the broaching operations on the blade ends

gaged in removing a locating block with its finished blade from the work-holding fixture in front of the right-hand ram of the broaching machine. The Christmas tree end of the blade is broached by this ram while the shroud end is finished by the broaches of the left-hand ram. (This ram was in the down position at the time that the photograph was taken.) The blades are forged from AMS-5382 alloy.

The machine on which this operation is performed is one of a new line being introduced on the market by the Detroit Broach Co. The line includes vertical single- and twin-ram surface broaching machines, vertical down-pull internal broaching machines, horizontal internal broaching machines, and light and medium presses. Vertical machines can be furnished in capacities from 5 to 35 tons and in various lengths of stroke from 30 to 100 inches. Horizontal internal broaching machines will be built in sizes from 3 to 50 tons. All these machines are hydraulically operated, Oilgear equipment being used exclusively.

One of the important design features is a preloading arrangement which insures that the tool-slides will move through their entire stroke within an accuracy of 0.0005 inch. The preloading device incorporates a roller which bears against the left-hand edge of each slide, as seen in Fig. 3, so as to force the opposite side of the slide against a highly accurate way. Torsion bars exert a pressure of 1200 pounds in controlling the on-center downward movement of the broach tools. This provision eliminates any scuffing of broach teeth due to slide "run-out."

The knee of each machine is operated by a power unit that is entirely separate from the main power supply that actuates the rams. Speeds of operation are effected by making changes in the pumping equipment. The main pump cylinders are detachable as a unit. Their piston-rods are in tension during the broaching stroke, which insures maximum smoothness of this stroke. Reversing pumps are provided, with the result that little piping is required in the machine and this minimizes the likelihood of oil leakage. The pumps are of the volumetric type.

Another feature of this machine is that when it is started up after having been idle overnight, the tool-slides will return to the proper starting position without any danger of breaking tools. The arrangement overcomes the tendency of some types of machines to settle overnight and in so doing move away from the trip-dogs. Unequal

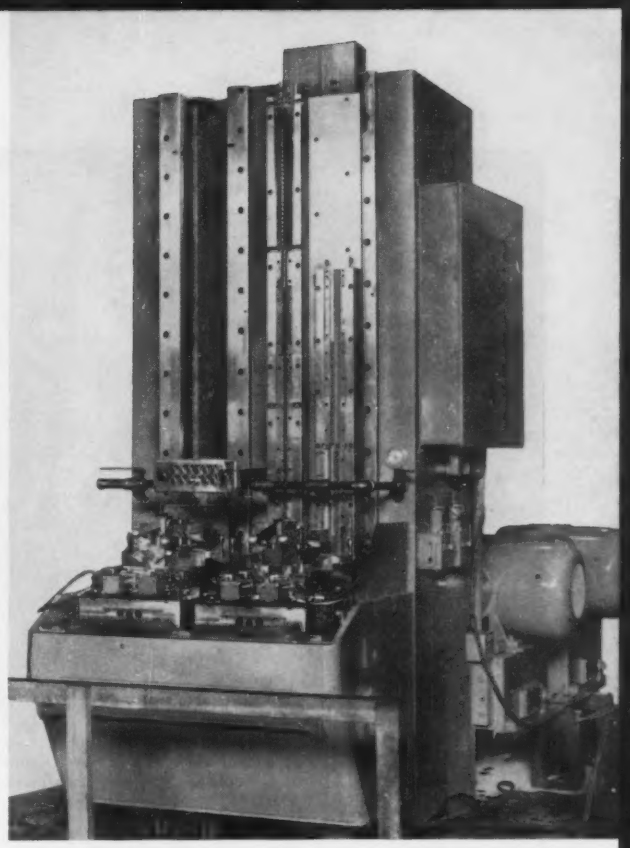


Fig. 2. General view of the 15-ton dual-ram machine which produces Stellite jet-engine blades at a broaching rate of 120 feet per minute

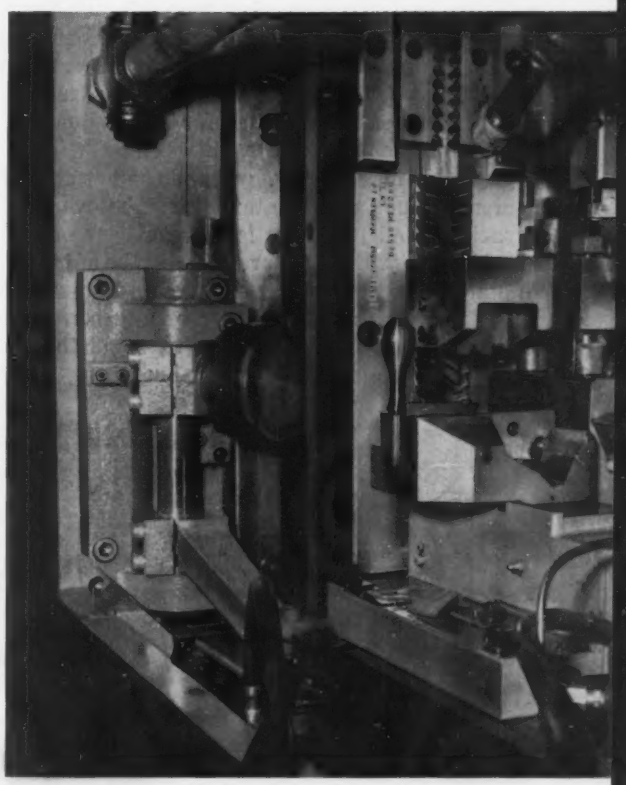


Fig. 3. Precise downward movement of each ram is insured by a roller and a torsion bar arrangement on the left-hand side of the ram.

Fig. 4. General view of the new machine-building shop showing several types of broaching machines in various stages of completion

loads on the slides of twin-ram machines do not have any effect on the length of stroke.

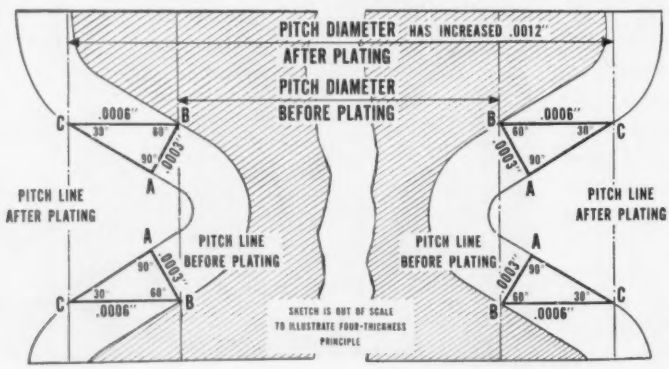
Vertical pull-down machines are equipped with a tool handling slide that is operated as a part of the main slide. It is not connected to the machine frame or mounted on it and follows the tool-slide until the broach has been released. This feature permits guiding of an internal broach to the point of disengagement and eliminates any tool whip which might result in tool breakage.

All machines are designed for semi-automatic and fully automatic cycles, as well as for selective manual inching. The hydraulic and electrical equipment meets J.I.C. standards. The overload capacity of all machines is 150 per cent of the rated capacity. Each fixture table can be adjusted in and out on the knee by means of a lead-screw which eliminates the necessity of adjusting the fixture on its table in order to regulate the amount of stock removed by the broaches.

Increase in Pitch Diameter of Plated Threads

When screw threads having an included angle of 60 degrees are electroplated, the pitch diameter of the thread is increased four times the thickness of the plating. This fact, which is seldom realized by people unfamiliar with plating of threads, is illustrated in the accompanying sketch, which has been drawn out of scale in order to illustrate the four-thickness principle.

The sketch was prepared by the Standard Pressed Steel Co., Jenkintown, Pa., with the intention of showing customers the precision required in forming and plating threads. As can be seen, a plating thickness of 0.0003 inch (represented by lines *A–B*) increases the pitch diameter of the thread 0.0012 inch (represented by twice the length of line *B–C*), as triangles *ABC* have included angles of 30, 60, and 90 degrees.



Plating thickness of 0.0003 inch (lines A–B) increases the pitch diameter of the screw thread 0.0012 inch.

Modified Die Twist-Clads Uranium Rod

By Herbert V. Ross
Superintendent of Central Shops
Argonne National Laboratory, Lemont, Ill.

JACKETING a 16-foot length of uranium rod with a finned aluminum tube while simultaneously twisting the tube to a fixed lead of 48 inches, was the problem faced by the Central Shops of the Argonne National Laboratory, Lemont, Ill. In addition, it was necessary that the loose-fitting tubing, a cross-section of which may be seen at X in Fig. 1, be drawn tightly over the rod without twisting it. Since only twenty assemblies were required, ten with a right-hand lead and ten with a left-hand lead, an inexpensive method of drawing and twisting the tube was sought. The problem was solved by following a method devised by Carl Munter, instrument maker in the special materials shop.

All the design features necessary to accomplish this job satisfactorily are embodied in the drawing die assembly shown at Y. Housing *A* is counterbored to receive tapered roller bearing *B*. Into the bearing bore are fitted a die-holder *C* and drawing die *D*. The die itself is a standard unit consisting of three individual die segments, each held in place by a socket head cap-screw. The assembled unit may be seen in Fig. 2.

A 7/16-inch wide groove is machined around the periphery of the die-holder. The diameter of this groove is such that when a 3/32-inch diameter braided wire cable is wrapped around it, the circumference of the axis of the cable is exactly 1 foot. As seen in Fig. 3, one end of the cable is fastened to die-holder *E* and a minimum of four wraps are laid within the machined groove. The end of the cable leads upward through a block and tackle (not shown) having

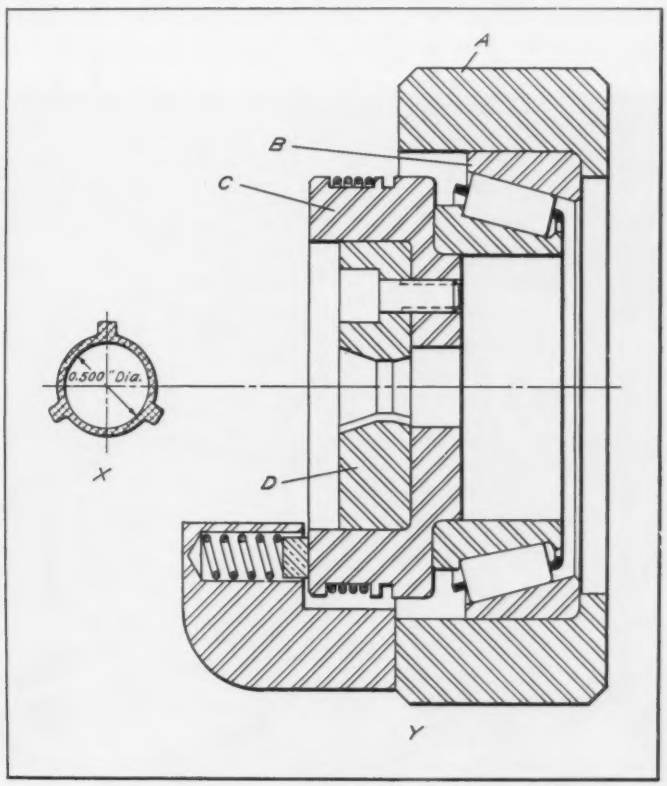
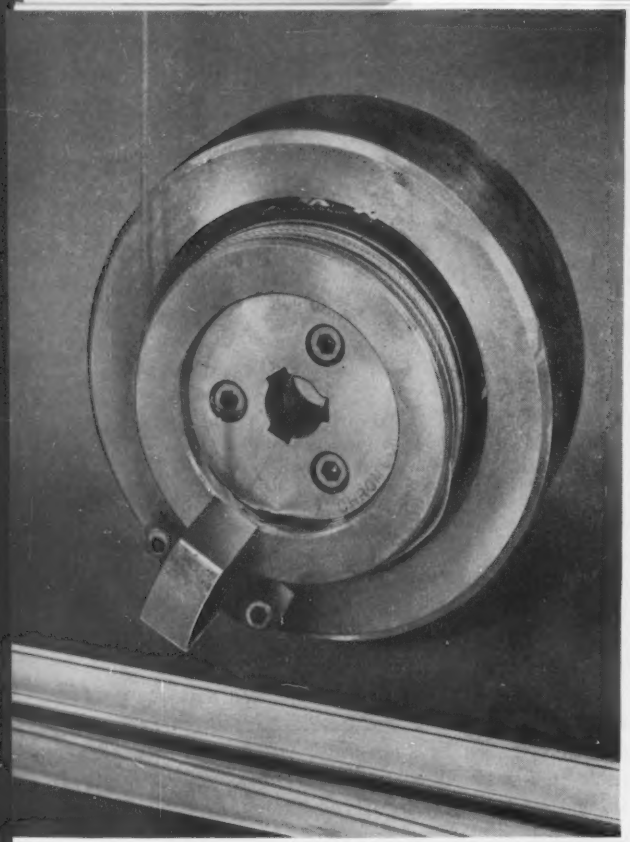


Fig. 1. Sectional view of drawing die employed to jacket uranium rod with finned aluminum tubing. The tubing, a cross-section of which is shown at view X, is twisted as it is drawn.



four strands of wire (mechanical advantage 4 to 1), then through a small sheave *F* on the die support plate *G*, and is finally secured to the moving carriage *H* of the draw-bench.

In preparation of the work, a small hole is drilled and tapped in the end of the uranium rod. Into this hole is screwed a tapered steel adapter stud. The end of the finned aluminum tube is locked in place by swaging its end over the tapered portion of the adapter stud.

The operation is begun by passing the stud through the draw die until the tube fins are engaged. Carriage jaws *J* are then clamped on the stud and the braided cable pulled taut. As the carriage moves away from the die, it pulls the rod and tubing with it, thus effecting the jacketing of the uranium rod. The carriage also pulls the cable, causing the die to rotate.

When the carriage and tube move a distance of 4 feet, the cable leading from the block and tackle to the die moves only 1 foot. This action causes the die to rotate exactly one revolution, thus producing the desired 48-inch lead. The lead produced is accurate to within plus or minus 1/8 inch per 48 inches, or plus or minus 0.25 per cent. To produce a lead of the opposite hand, it is only necessary to reverse the direction of wrapping the wire cable around the die.

Different leads can be obtained by varying the number of strands in the block and tackle. Also, variable leads can be arrived at, within limits, by taper-turning the drawing die.

The savings derived from this method in contrast to the cost of constructing a gear-driven unit are readily apparent. An additional advantage of this set-up is that standard parts are employed and, after use, returned to stock. Even the machining of the outside diameter of the die-holder does not impair its future use in normal drawing operations.

Fig. 2. (Top) Drawing die assembly showing braided wire cable used to rotate the die to impart a twist to the work. In the foreground may be seen two sections of finned tubing—the upper one before twisting, and the lower one after twisting.

Fig. 3. (Left) Rotating die is mounted in draw-bench to twist-clad a uranium rod. The tube and rod enter the drawing die from the right and emerge as one unit at the left. The rate of cladding is 44 feet per minute.

Universal Drilling Machine Built Around Dial Principle

MACHINE shops of companies concerned with some phase or other of airplane jet-engine manufacture eventually acquire a singular pattern. To accommodate the preponderance of cylindrical bodies, rings, and discs in the engine, it is logical that much of the shop equipment—machines, work-fixtures, and jigs—are of circular configuration. In this category is a universal drilling machine developed by the Hartford Special Machinery Co., Hartford, Conn. This machine is of particular interest because it demonstrates how, by good design, a high degree of flexibility can be retained in a specialized machine tool.

In principle, the work is supported over a dial, or circular table, that executes an indexing motion timed to the operation of one, two, three, or four drilling heads stationed at points around the dial periphery. Dial indexing and drilling head cycling are automatic, it being necessary for the operator only to load and unload the work. Both the number of indexes and the magnitude of the indexing arcs are completely variable, and the drilling head stations have a wide range of adjustment, peripherally and radially. With its high degree of set-up flexibility, the equipment ably suits jet-engine production, where design changes are frequent.

In the heading illustration is shown a universal drilling machine installation at the Valley Stream, N. Y., plant of the Fairchild Engine Division, Fairchild Engine & Airplane Corporation. This is one of the Division's three Long Island plants which are suppliers of parts for the General Electric J47 engine. Set up on the machine is a forward frame in which two bolt circles are being drilled. It is a magnesium casting approximately 34 5/8 inches in diameter. Completed frame can be seen at the left.

Three work stations—two vertical, one horizontal—have been furnished with this particular machine, although only the two vertical stations are required for the operation in progress. Here used for drilling, the stations can be adapted to

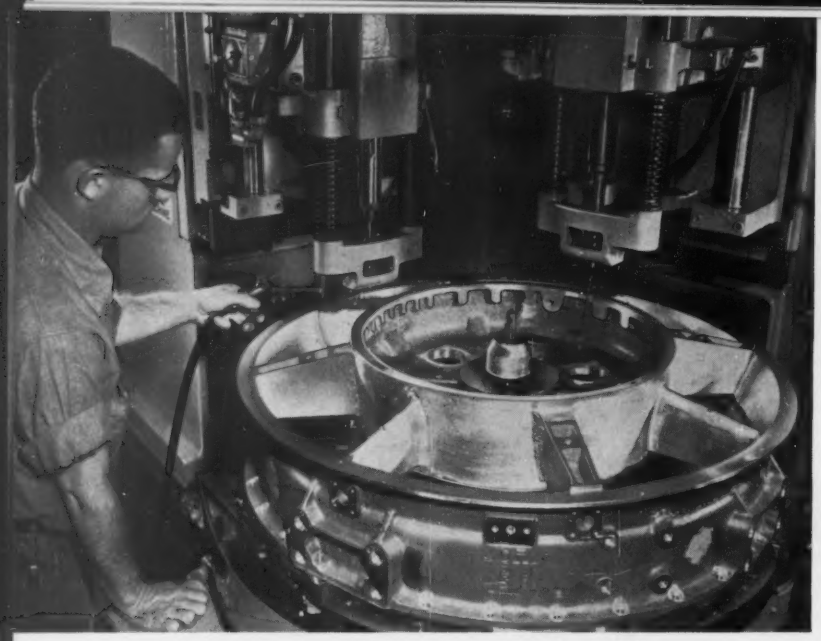


Fig. 1. The stations are equipped with spring-loaded guide plates which hold drill bushings to assure the accuracy of the two bolt circles.

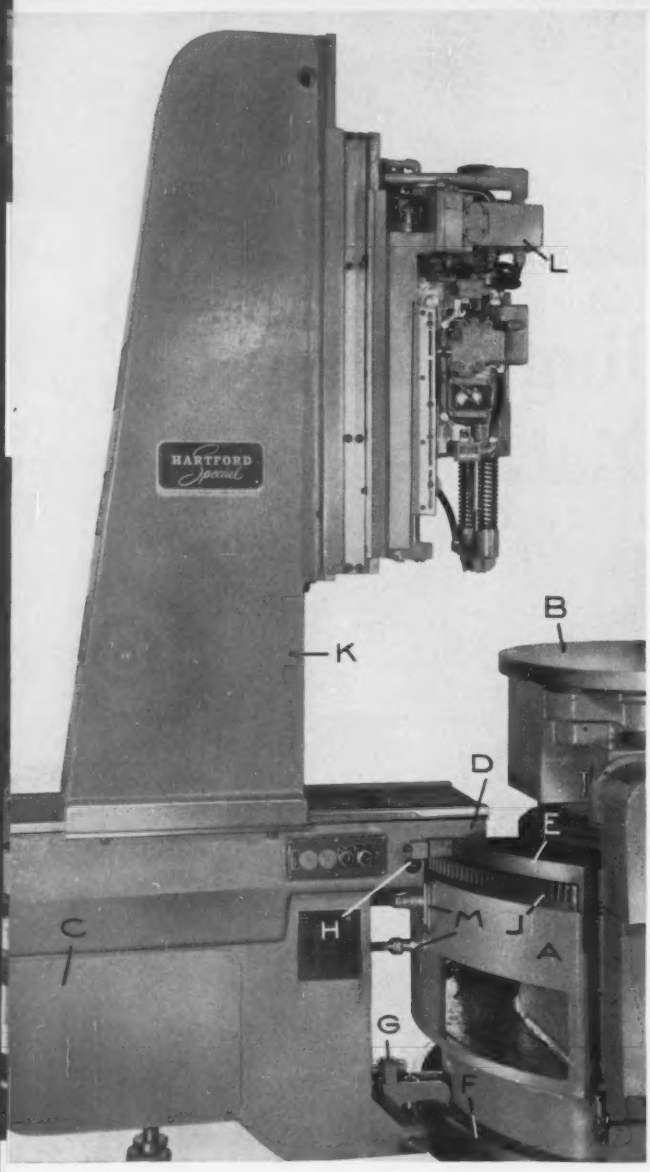


Fig. 2. Knee adjusts peripherally around the table, and column adjusts radially along the knee.

related operations, such as tapping and face-milling. The close-up view, Fig. 1, shows the location of the drills over the work. The dial indexes clockwise, as viewed from above; at the first station, the outer bolt circle is drilled, and at the second station, the inner one.

The design of the machine can be seen in Fig. 2. A circular cast-iron base *A* supports the dial *B* and contains the indexing mechanism. Also in the base are a coolant pump and a reservoir. Each station has a knee, or base extension, *C*. This member is provided with a lip *D* which is coupled to a ledge *E* on the top of the base. The weight of the knee is borne by a rim *F* through a roller bearing and shoe assembly *G*.

The knee can be located at any point around the base within an arc of 240 degrees. To move the knee, assembly *G* is first pivoted to free the shoes from the rim and bring the roller bearing into contact with the rim. A crank is then slipped over the end of a worm *H* meshing with a rack *J* fastened to the ledge.

Mounted on the knee is a massive column *K* which supports the drilling head *L* in a vertical position. (At horizontal stations, the head is supported directly on the knee.) Radial location of the head can be adjusted for any bolt circle diameter between 4 and 56 inches. For this, a nut in the bottom of the column engages a screw anchored between the ways of the knee. In the column face, a similar screw provides the means for adjusting the elevation of the head so that the spindle, when fully retracted, can be from approximately 11 1/2 to 39 inches above the table. Plug-in outlets *M* are located at four different points around the base. Power, control,

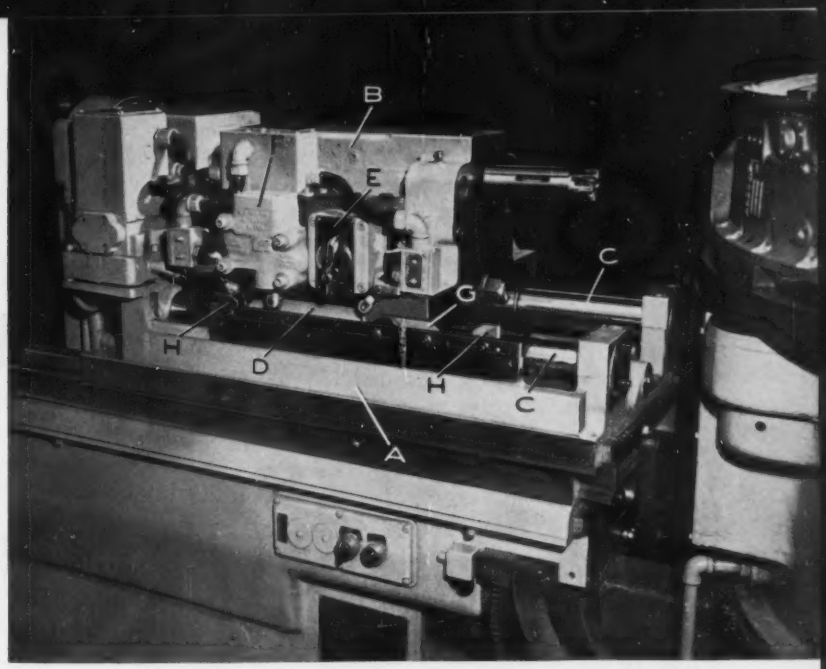


Fig. 3. The rods (C) serve the dual purpose of being ways for the housing and stationary pistons in the closed hydraulic system.

and air lines can be extended from each of the outlets to an adjacent drilling head.

The heads are self-contained units having separate drives and hydro-pneumatic feed mechanisms. A range of sixteen spindle speeds from 179 to 6720 R.P.M. is provided for by a two-speed motor, four-step sheaves, and back gears. The parts of the feed mechanism are identified in the illustration of the horizontal unit, Fig. 3.

A 6-inch diameter pneumatic cylinder, which is enclosed in the upper slide *A* of the head, furnishes the forward thrust to the spindle housing *B*. Anchored to the ends of the upper slide is a pair of 2-inch rods *C* which serve as the ways for the spindle housing. These rods also act as pistons in cylinders *D* which move with the housing and form part of a closed hydraulic circuit. When the housing moves, oil is displaced from one end of the cylinders to the other. By means of a flow control valve *E*, a deceleration valve *F*, and a deceleration dog *G*, it is possible to pre-set a drilling cycle that includes a quick advance, a feed or skip feed, a dwell interval, and a quick return. The housing movement, adjustable up to 8 inches, is limited in both directions by reversing dogs *H*.

The dial is driven by a 3/4-H.P., 1200-R.P.M. brake motor through an over-running clutch. Motor speed is reduced in transmission by a V-belt drive and a compound worm-gear train. For each application, a special detachable notched index-plate and a fixture baseplate are designed and fastened to the dial.

In operation, when the drilling heads have completed their cycles, the dial drive motor is energized for clockwise rotation. In rotating, the appropriate notch in the index-plate passes a fixed spring-loaded latch, at which moment the motor is reversed until the notch contacts a locating surface on the latch. Then, the dial drive circuit is opened and a magnetic brake locks the dial in position. The final rotation of the motor is absorbed by the over-running clutch, which slips in reverse once the notch has been located against the latch.

A control assembly mounted in the front of the base contains a series of cams, micro switches, and solenoids by means of which the operation of the machine is entirely automatic. A single push-button panel is used to institute automatic cycling or jog-forward or jog-reverse movements of the dial and the drilling heads.

* * *

"Storage Engineering" Service

A new customer service in "storage engineering" has been established by the Republic Steel Corporation. This field of service is being set up principally at the company's Berger Mfg. Division, Canton, Ohio, to provide specialized consultation in the planning, lay-out, and installation of bins, shelves, and racks in parts storage areas.

Certain procedures in planning an efficient storage area will be followed. A complete inventory of all items to be stored, including part numbers and names together with normal quantities to be stored, will be taken. The size, weight, and silhouette of each part must be obtained. Using this information, measurements may be made concerning the size and load-carrying capacity of all bins and shelves. Each of these bins and shelves will be identified with part numbers. The floor plan for aisles and storage units is then laid out, followed by the setting up of a logical numbering system with the items in most demand arranged in convenient locations.

Materials OF INDUSTRY

The properties and new applications of materials used in the mechanical industries

Heavy-Duty Abrasion-Resistant General-Purpose Steel

Jalloy Grade 3, an alloy steel for heavy-duty use, currently available from the Jones & Laughlin Steel Corporation, 3 Gateway Center, Pittsburgh 30, Pa., is a general-purpose steel which is capable of heat-treatment. In the as-rolled condition, it offers good resistance to abrasion or wear; when heat-treated to a Brinell hardness range of 340 to 388, it gives optimum results in wear or abrasion resistance.

The chemical composition of Jalloy Grade 3, in per cent, is as follows: carbon, 0.25 to 0.31; manganese, 1.35 to 1.65; phosphorus, 0.04, maximum; sulphur, 0.04, maximum; silicon, 0.15 to 0.30; molybdenum, 0.10 to 0.20; and iron, the balance. The steel is also available with a minimum of 0.20 per cent copper for improved resistance to atmospheric corrosion, if so desired and specified. This alloy is being used for mine, farm, and earth-moving equipment, and wherever abrasion or wear resistance is a requisite.

Aluminum Forging Alloy Developed for Aircraft Industry

A high-strength aluminum forging alloy has been developed by the Aluminum Company of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa., for the aircraft industry. The alloy, called X7079, exhibits great uniformity of properties in heavy sections and good ductility in cross-grained directions.

The guaranteed minimum mechanical properties established for X7079-T6 hand forgings up to 7 inches in thickness, heat-treated in full section, are a tensile strength of 73,000, 70,000 and 65,000 pounds per square inch and a yield strength of 62,000, 60,000 and 54,000 pounds per square inch in the longitudinal, long transverse, and short transverse directions, respectively.

Die forgings up to 7 inches in thickness made of the same material have a guaranteed minimum tensile strength of 74,000 pounds per square inch, a yield strength of 64,000 pounds per square inch, and an elongation in four diameters of 10 per cent for all those specimens the axes of which are parallel to the forging flow lines. All other specimens, of which the axes are not parallel to the forging flow lines, have a guaranteed minimum tensile strength of 72,000 pounds per square inch, a yield strength of 61,000 pounds per square inch, and an elongation in four diameters of 4 per cent.

Like 7075 alloy, X7079 develops optimum mechanical properties after solution heat-treatment and artificial aging. Such heat-treatment is carried out at somewhat lower temperatures than those employed for 7075. Quenching and artificial aging practices also differ.

Tests have shown the new alloy to be at least equal and probably superior to 7075-T6 from the standpoint of resistance to stress corrosion cracking. The machinability of X7079-T6 is expected to be the same as for 7075-T6; however, because of its lesser susceptibility to mass quenching effect, the greater uniformity of hardness and mechanical properties should make for more uniform machinability. Tests have shown X7079-T6 to be somewhat less susceptible to distortion during machining than 7075-T6 and 14S-T6.

Stripper that Removes Deposits by Simple Method

A non-acid, rust-removing material that simultaneously strips paint, rust, and primer from ferrous metal surfaces in a two-step process has been developed by Turco Products, Inc., 6135 S. Central Ave., Los Angeles 1, Calif. Rustgon, as the stripper is called, contains no cyanide compounds, requires no electrolytic action, and gives off no corrosive fumes. It is used full strength in a hot tank. Parts to be treated are immersed in this tank for from less than a minute to a few minutes, depending upon the type and condition of the deposit to be removed. The parts are then withdrawn and rinsed with air and water or with steam. No extra dip is needed for rust prevention since metals derusted with this stripper are no more susceptible to rusting than is new metal.

Structural Adhesives Bond Metal to Plastic or Metal

Two structural adhesives for bonding metal to metal and metal to plastic—one for normal temperature use and the other for elevated temperature service—have been developed by the Rubber & Asbestos Corporation, 225 Belleville Ave., Bloomfield, N. J. Originally developed for aircraft structural applications, these formulations appear to offer widespread applicability to industrial production needs.

Bondmaster M615, the formulation intended for normal temperature use, is said to exhibit shear strengths (under the Air Force tensile shear method) of up to 3500 pounds per square inch with an accompanying peel strength (NEMA method) of up to 19 pounds. The second formulation, Bondmaster M616, is claimed to provide shear strengths up to 3000 pounds per square inch at a temperature of 180 degrees F.

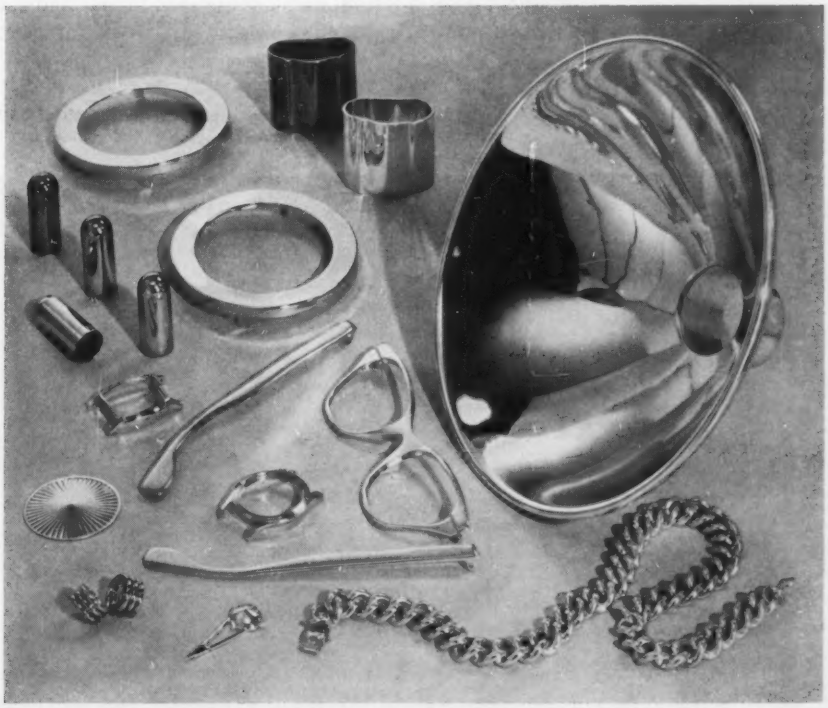
Liquid Pickle Control that Is Easily Added to Bath

A liquid inhibitor for sulphuric, hydrochloric, or phosphoric acid, or mixtures thereof, that also provides a controlled foam blanket on pickling solutions, has been brought out by Oakite Products, Inc., 126 Rector St., New York 6, N. Y. Called Oakite Pickle Control No. 5, it is a viscous red-brown liquid with a characteristic odor and its pH is approximately neutral. The normal range of the inhibitor concentration is said to be 0.1 to 1 per cent by weight of concentrated acid in the solution. The inhibitor is added either manually or by proportionating equipment to the acid solution at its operating temperature. It has been designed for use in continuous steel strip mills, where the addition of an inhibitor through proportionating equipment is preferred, and in batch pickling operations, because of the ease of making additions.

Water-Miscible Drawing Compound Alleviates Caking on Dies

A drawing compound, which is water-miscible in ratios ranging from equal parts to 1 to 15 parts, has been placed on the market by the Texas Co., 135 E. 42nd St., New York 17, N. Y. Texaco Drawing Compound No. 3, as it is called, is a mixture of mineral oil, emulsifying agents, non-abrasive pigment, and a dispersion additive which insures against its caking on dies and knock-out or stripper mechanisms. It was developed to handle work being processed under difficult forming conditions where an economic, miscible material is desirable. The compound is easily removed by water washing.

An advantage obtained by its use is the prevention of metal-to-metal contact which virtually eliminates die galling, sticking, and seizure. The soft filler contains no abrasive material.



Lightweight metal parts made from Lurium, a series of high-purity aluminum and aluminum alloys, which is available from Fromson Orban Co., Inc., New York City. Colors of unlimited range can be supplied. Parts are of unusual brilliance and tarnish-proof. (Lurium was previously described in MACHINERY, January, 1954, page 199.)

Sectionized Automation–A Major Advance in Transfer Machining

A 350-foot long transfer machine for V-8 engine cylinder blocks has been divided into five sections so that one or more sections can be shut down without interrupting the production of others

A MAJOR problem in the development of automation has been the interruption of production when transfer machines are shut down for necessary tool changes, maintenance, or repairs. To prevent loss of production during periods of "down" time, The Cross Company, Detroit, Mich., has developed "sectionized automation."

Sectionized automation—or "segmented automation," as it has also been called—is based on the division of a transfer machine into sections to permit shutting down some sections without interfering with the production of others. Space is provided between successive sections for banking work-pieces should the next section be inoperative for any reason. When the dull tools have been replaced, or the trouble corrected, on the section that has temporarily been shut down, the section is returned to automatic operation in sequence with the other sections. Banked parts can then be reintroduced into the production line.

An integral part of this important development is a new arrangement for work transfer. Each section of the completely integrated production machine has a primary and a secondary transfer mechanism. All primary units, which are of the lift-and-carry type, work simultaneously, and transfer the parts forward from station to station within the sections. The secondary units move the work-pieces from the unloading station of one section to the loading station of the next section during the time that the tools are cutting. Or, in case one section has been shut down for tool changes or repairs, parts from the preceding section are transferred to a storage bank.

Outstanding as an example of sectionized automation is the Cross Transfer-matic seen in Fig. 1. This 350-foot long transfer machine performs a total of 555 operations on V-8 engine cylinder blocks, with each part handled in seven different positions. The two views of a block in Fig. 2 give some idea of the numerous holes that are drilled, reamed, tapped, and bored, and of surfaces that

Fig. 1. U-shaped transfer machine having an over-all length of 350 feet performs 555 operations on V-8 engine cylinder blocks.

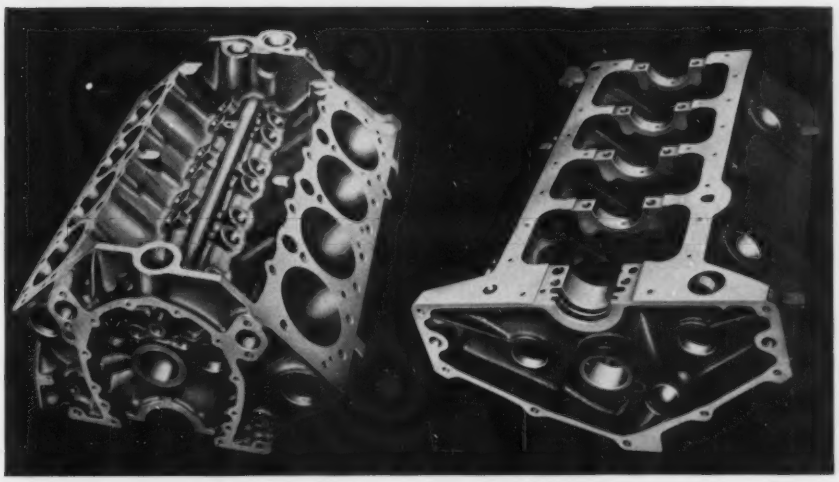


Fig. 2. Two views of cylinder block for V-8 engine showing some of the holes that are drilled, reamed, tapped, and bored on transfer machine, Fig. 1.

are milled. Itemizing the operations, they are as follows: 265 drilling, 6 milling, 21 boring, 56 reaming, 101 countersinking, 106 tapping, and 133 inspecting. A production rate of 100 cylinder blocks per hour is possible at 100 per cent efficiency, with 104 work-pieces in process at the same time.

From the diagram in Fig. 3, it can be seen that the Transfer-matic forms a U-shape, and is divided into five working sections. Storage space for banking cylinder blocks is provided between successive sections. Blocks entering this machine have had top, bottom, and bank faces broached; ends milled; main bearings straddle-milled; cylinders rough-bored; and two locating holes in the pan face drilled and reamed.

At the front end of the first section, Fig. 4, the operator positions the V-8 engine cylinder blocks in the loading station and initiates the automatic cycle. From this point on, the parts are transferred, positioned, machined, and inspected —all automatically. This operator and three tool setters are the only labor required for the entire machine. By providing a positioning device at the loading station and a bank of cylinder blocks, manual loading could be eliminated.

The first section of the Transfer-matic is 62 feet long and contains thirty-two stations for machining the front and rear ends of the block castings. In the front end, chain cover mounting holes and water outlet flange holes are drilled, chamfered, and tapped; chain cover dowel-holes and welch plug holes are drilled and reamed; oil-gallery holes and three cam bearings are bored; oil grooves are milled in three cam bearings; an angular hole from a cam bearing to an oil gallery, water outlet holes, and vent holes are drilled; and engine support holes are drilled and tapped. In the rear end of the casting, the flywheel housing mounting holes are drilled, chamfered, and tapped; flywheel housing dowel-holes and welch plug holes are drilled and reamed; oil-gallery holes and angular holes from the cam bearings to the oil galleries are drilled; two cam bearings are bored; and oil grooves are milled in two cam bearings.

The first lift-and-carry type primary transfer mechanism carries the parts from station to station, where they are located by means of pins entering holes previously drilled and reamed in their pan faces, and clamped hydraulically. This type transfer device facilitates maintenance, since there are no slide rails to interfere and work-pieces can easily be removed at every station. Machining units are of modular construction, using standard way type feed units and other standard components throughout. Also, standard motor-driven hydraulic pump and tank units are used to supply fluid power for feeding, clamping, and transferring.

At Stations 17 and 18 of the first section, the angular holes extending from the cam bearings to the oil galleries are drilled upward from angular units mounted below the transfer level. In Fig. 5 is seen a close-up view of Stations 23 and 24. Head *H* at Station 23 automatically inspects the oil-gallery holes by means of probing pins. Compressed air is forced through holes drilled in the centers of the probing pins to blow out chips. If the pins fail to enter the castings because of broken-off tools or unmachined holes, they are automatically retracted and the first section of the machine is stopped. Unit *U* at Station 24 is a mechanism for pressure-testing the oil-gallery holes. If the pressure test is unsatisfactory, a spot of paint is sprayed onto the block and the part is salvaged or scrapped after it leaves the line.

An oil groove is milled in each of the five cam bearings at Stations 29 and 30 of the first section. Two cutters are mounted on the arbor at Station 29, and three on the arbor at Station 30.

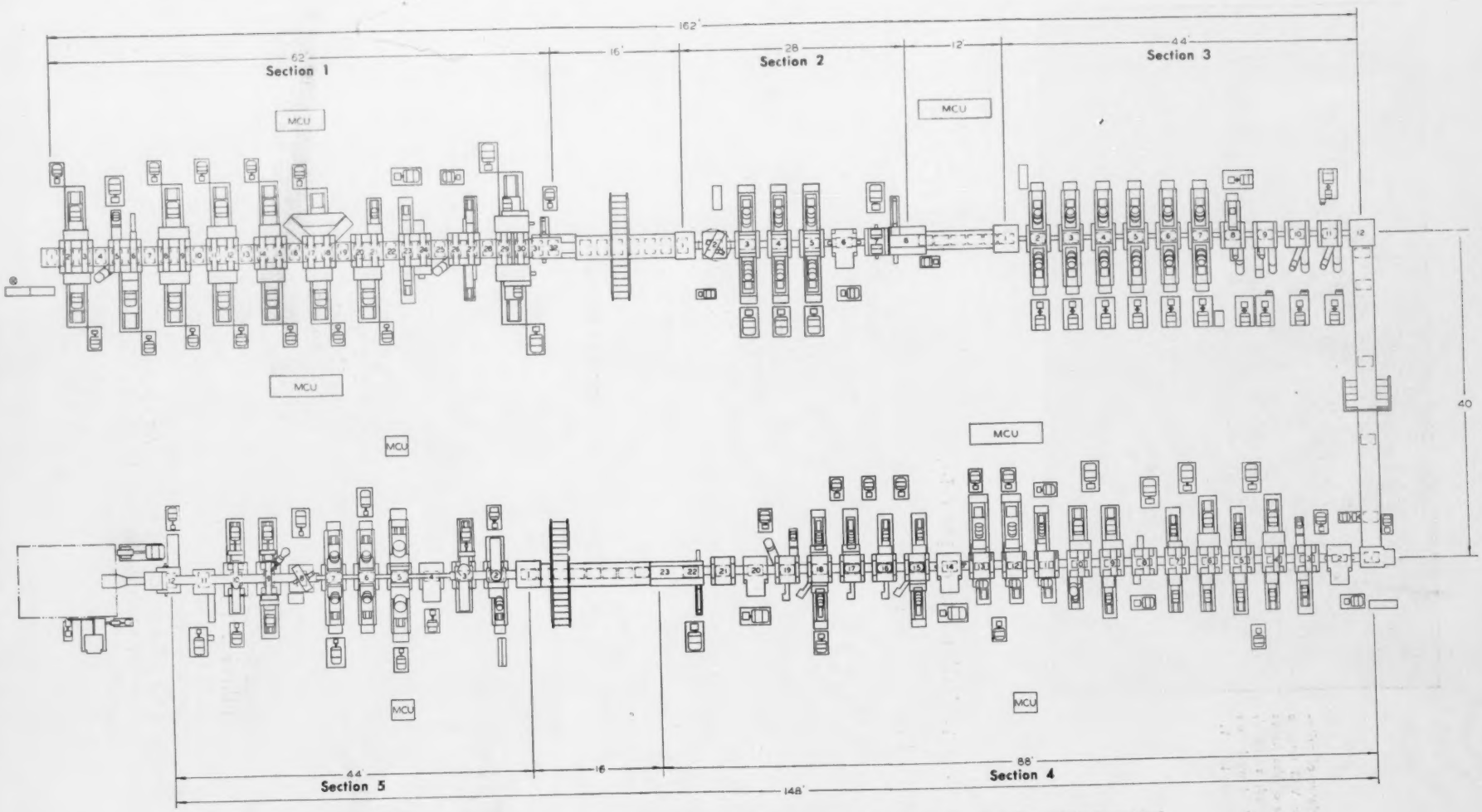


Fig. 3. Transfer machine is divided into five working sections, with storage space for banking blocks provided between successive sections. Secondary transfer units are provided to move parts from unloading station of one section to loading station of next section.

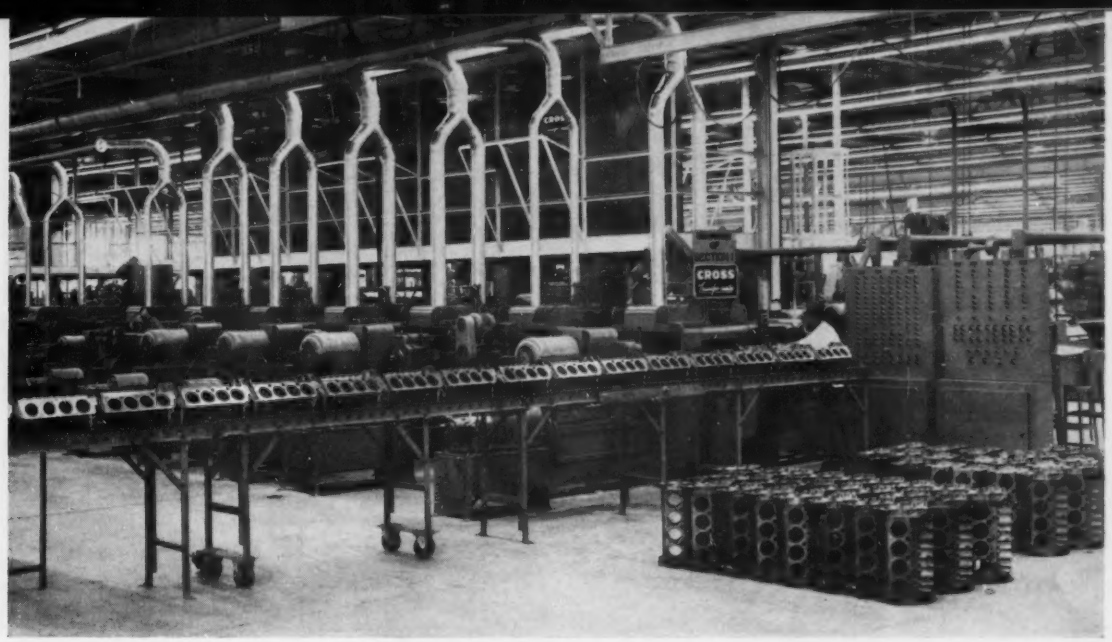


Fig. 4. Operator locates cylinder blocks in loading station at front end of first section. Parts are automatically transferred, machined, and inspected.

These arbors are fed into the blocks eccentrically for clearance, entering pilots on the opposite side of the machine. Then the arbors are fed along the transfer axis of the machine to depth and eccentrically to mill the oil grooves.

A secondary overhead transfer unit, which pushes the cylinder blocks along slide rails, is seen in Fig. 6 between the unloading station of the first section (right) and the loading station of the second section (left). The secondary transfer mechanisms advance the parts between sections during the time that the tools are cutting and the primary transfer units are at rest. Thus, the unloading stations of all sections are vacated and the loading stations are filled, and jamming up of parts is prevented.

Here is where the benefits of sectionized automation are first encountered. If, for example, it is necessary to shut down Section 2 to change one of the tools, the operator continues to feed parts into Section 1 without interruption. Cylinder blocks coming out of the first section are banked up in front of the second section. A 16-foot long floor area is provided between the first and second sections for this purpose. Although not provided on this particular installation, an automatic banking mechanism and storage conveyors can be used here.

Simultaneously, cylinder blocks banked at the end of Section 2 are fed into Section 3, and this and succeeding sections remain in full automatic operation. After the dull tool in Section 2 has

Fig. 5. Close-up view of Stations 23 and 24 on first section of transfer machine. Oil-gallery holes are mechanically inspected and pressure-tested here.

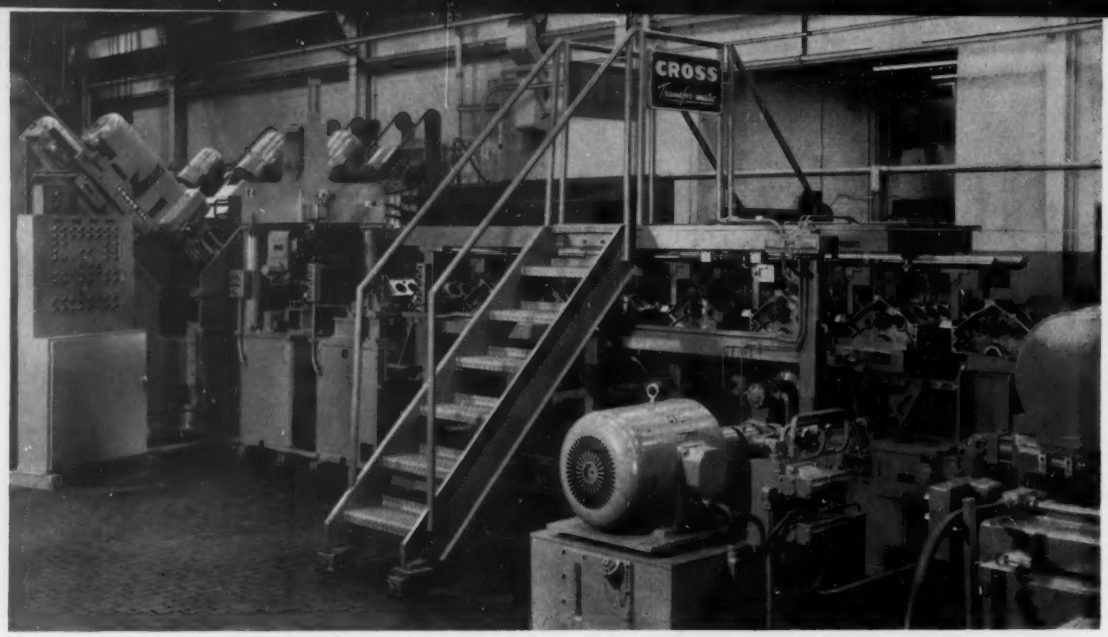


Fig. 6. Secondary transfer unit slides cylinder blocks along rails from unloading station of first section to loading station of second section.

been replaced with a sharp one, this section can be returned to automatic operation in sequence with the other sections.

Seven machine control units, such as the one seen in Fig. 7, are placed conveniently along the line to service all tools. The small rectangles marked "MCU" on the lay-out, Fig. 3, are these machine control units, on which are mounted Toolometer memory units for programming tool changes. One Toolometer is provided for every tool or group of similar tools on the machine. All Toolometers are electrically interlocked with the machine cycle, and every time a work-piece is produced, the hands of the Toolmeters index a small increment counter-clockwise. When one of the hands reaches its zero position, the section of the machine to which it is connected becomes inoperative and the operator knows that it is time to change tools, as well as which tools to replace.

After the dull tools have been replaced (together with any tools that other Toolometers show are almost ready for replacement), the Toolometer hands are manually rotated clock-

Fig. 7. Machine control unit contains Toolometer units for indicating when tools require changing, spare tools, and gages for pre-setting the tools.

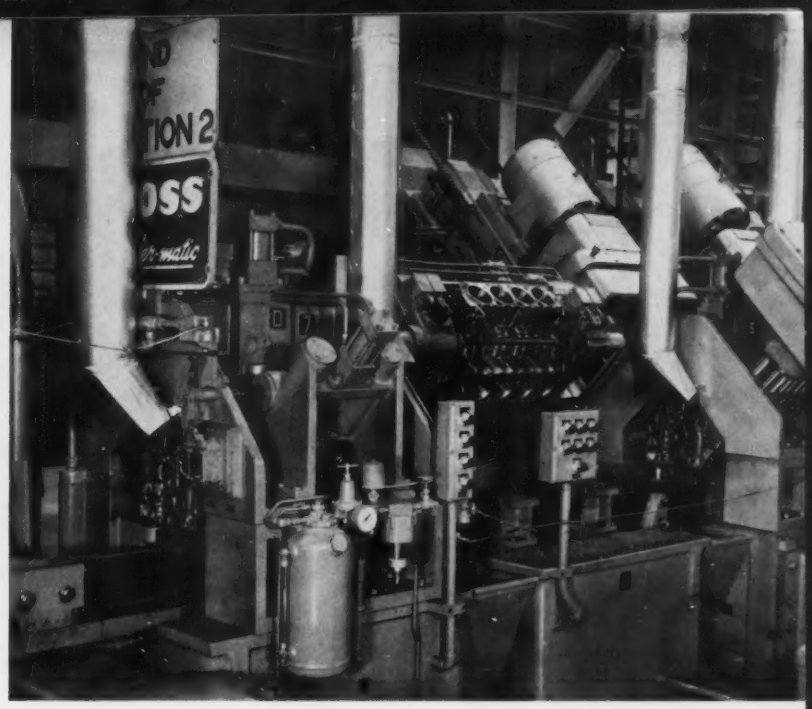


Fig. 8. At Station 6 of the second section, cylinder blocks are lifted and rotated 360 degrees in order to dump chips accumulated from previous operations.

wise to their starting positions, thus establishing new programs for the sharp tools. The affected section of the machine can then be returned to automatic operation in sequence with the other sections. The machine control units also include storage space for spare tools and gages for presetting the tools, thus minimizing machine "down" time. With pre-set tools, trial cuts and machine adjustments are not necessary.

Station 1 of the second section may be used as a loading station when this section is in operation, or as a station for removing parts for banking when this section is shut down. An independent primary transfer mechanism carries the part into Station 2 of the second section. Here, the cylinder block is indexed 90 degrees in a horizontal plane to position it for machining the bank faces. After drilling the stud, bracket, water, oil dip-stick, and welch plug holes in the bank faces at the third, fourth, and fifth stations, the blocks are lifted and rotated 360 degrees at Station 6 in order to dump the chips, Fig. 8. At Station 7 in this illustration, the holes are automatically inspected by probing pins.

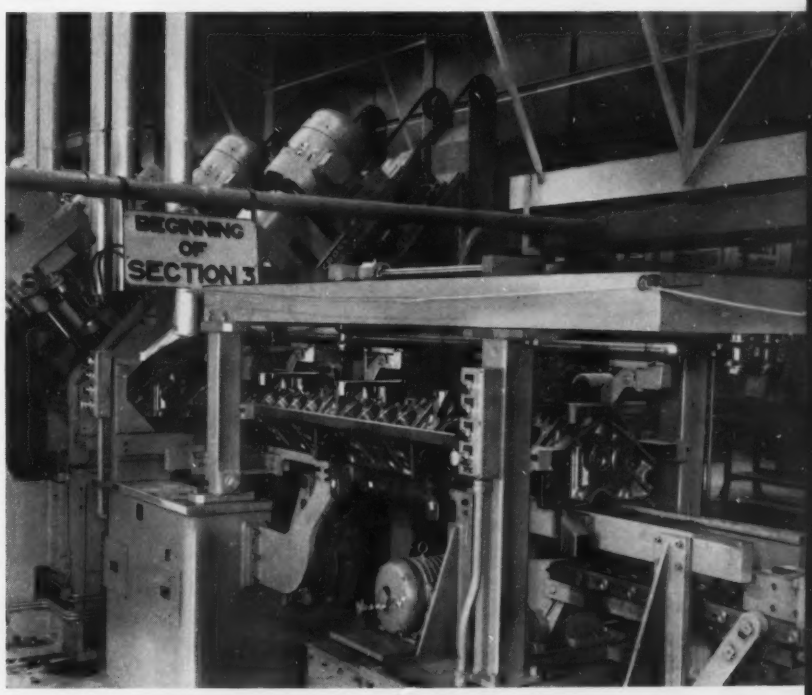


Fig. 9. Secondary transfer unit for moving parts from second to third sections. If third section is shut down, cylinder blocks are stored here.

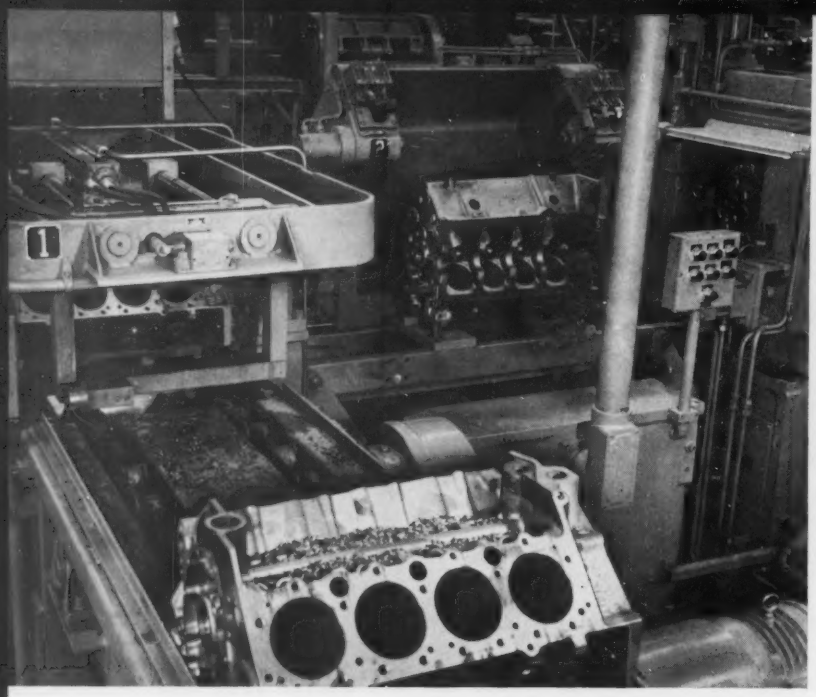


Fig. 10. A 40-foot long secondary transfer unit of the roller chain type carries blocks to loading station of the fourth section.

Another secondary overhead transfer unit, Fig. 9, and a storage area for banking cylinder blocks, are provided between the second and third sections of the Transfer-matic. The 44-foot long third section has twelve stations for drilling and rough and semi-finish reaming the valve lifter holes, and drilling oil holes in the tops of the blocks.

From the twelfth, and unloading, station of the third section, the blocks are carried at 90 degrees to the preceding direction of transfer to the loading station of the next section, Fig. 10. This is accomplished by a 40-foot long secondary transfer unit of the roller chain type, with the blocks resting on the traveling chain links. The fourth section, 88 feet long, contains twenty-three stations. At the second station, seen in the rear center of the illustration, the castings are indexed 90 degrees in a vertical plane to position them with their pan faces to the right and top surfaces to the left. At Stations 3 through 13, oil-pan, distributor, bearing cap, breather, and oil-fill holes are drilled.

Cylinder blocks are rolled over 90 degrees at the fourteenth station of Section 4. At successive stations in this section, water drain, welch plug, dowel, and fuel-pump mounting pad holes in the lower bank surfaces are drilled. The final secondary transfer unit and the last storage area for banking cylinder blocks are provided between the fourth and fifth sections of the Transfer-matic.

In the fifth section, holes in the pan faces, bank faces, and ends of the cylinder blocks are tapped, with the blocks being rolled over and indexed for correct positioning between successive operations. Also, at the sixth and seventh stations, the valve lifter holes are finish-reamed. In Fig. 11 is illustrated a single-spindle, hydraulically fed tapping unit for reaching a difficult location in the blocks. At the unloading end of Section 5, the parts are automatically turned upside down before they are transferred into the washing machine seen at the right in

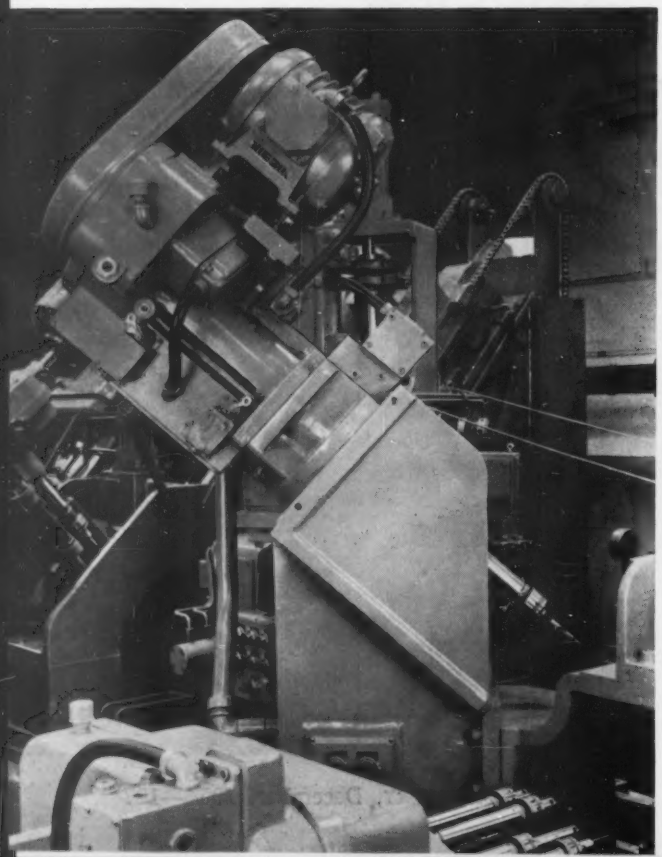


Fig. 11. Single-spindle, hydraulically fed tapping unit on the fifth section of transfer machine. This is the only section of the machine using coolant.

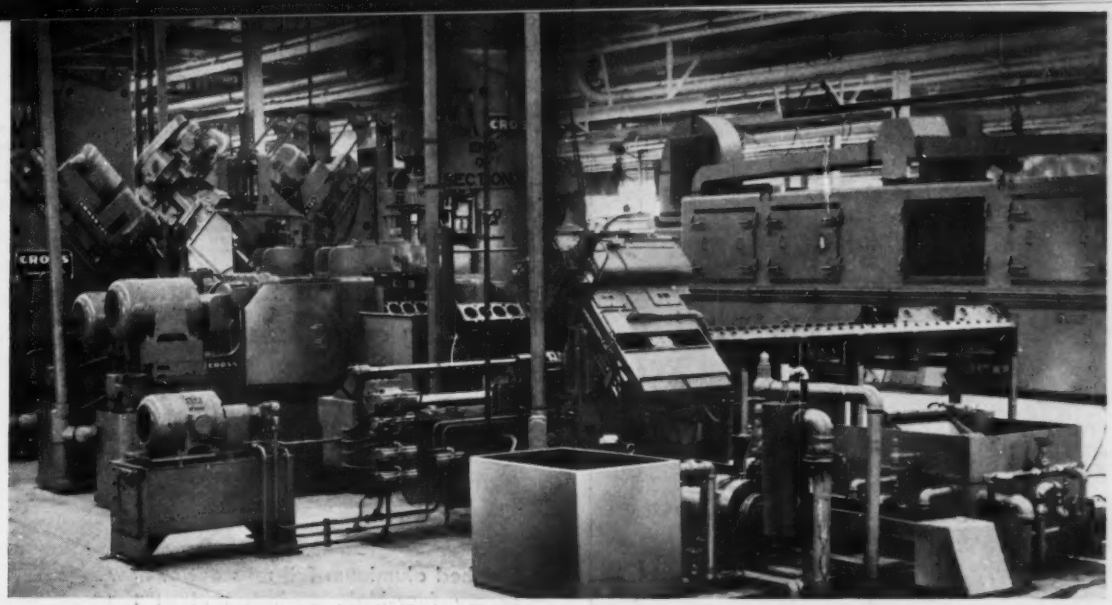


Fig. 12. Cylinder blocks for V-8 engine are automatically turned upside down and moved into a washing machine as they reach end of transfer machine.

Fig. 12. After washing, bearing caps are assembled to the cylinder blocks.

Included in the 104 stations on this five-section Transfer-matic are 53 for machining, 7 for parts handling, 6 for mechanical inspection, 36 for visual inspection, and 1 each for loading and unloading. Special maintenance features include complete interchangeability of all standard and special parts, construction to J.I.C. standards, and manifolded hydraulic valves and limit switches. An automatic chip conveyor and means for automatic lubrication of all machining units are furnished.

Maintenance and replacement of parts are facilitated by tags giving on-the-job operating instructions, such as identification and purpose of every piece of electrical and hydraulic equipment, feed rates for each unit, information for timing the tapping head lead-screws, and other pertinent data. Coolant is only employed on the fifth section for finish-reaming the valve lifter holes and the various tapping operations. A filter for the coolant is provided at the end of this machine section.

An interesting point is that the standard modular construction units or building blocks used in this Transfer-matic could be used to make seventy-seven single-purpose machines, such as tracer lathes, milling machines, and boring machines. Thus, protection against obsolescence is provided in case the special machine becomes unnecessary for the purpose originally intended.

Tips on Use of Diamond Tools

Diamond tools for dressing grinding wheels are precision tools and should be treated as such, both in the interests of diamond economy and of grinding efficiency. A recent article in *Diamonds In Industry*, published by J. K. Smit & Sons, Inc., pointed out that care should be taken not to bump the tool against the wheel, as a shock of this kind may result in fracture or complete destruction of the diamond. Although the diamond is extremely hard, it is also brittle and is easily damaged when subjected to a sudden shock or blow.

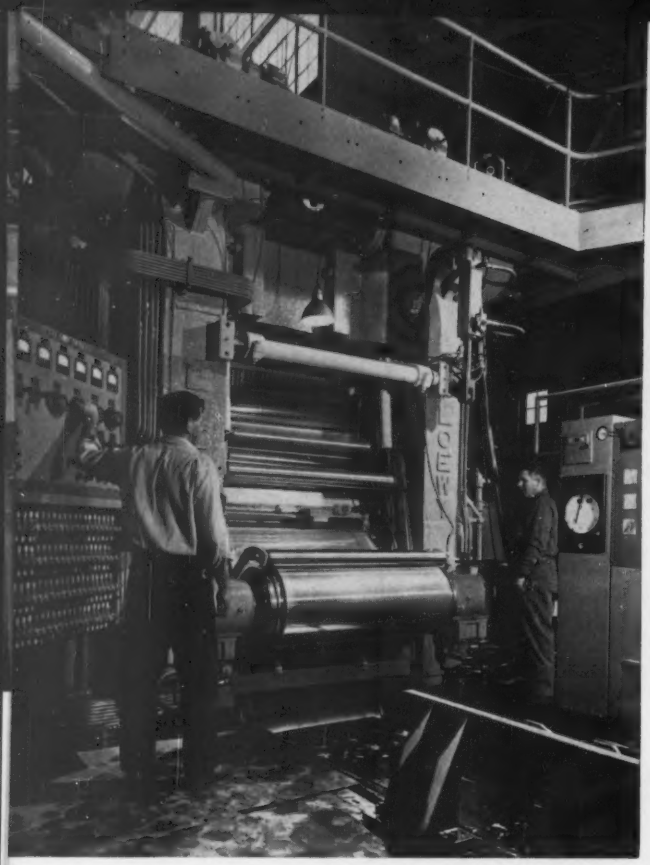
Assignment of a diamond tool to the care of one operator for his exclusive use results in longer life for the tool and better work from its use. Maintaining service records for each tool helps in locating conditions that can be corrected more easily when a diamond is in the custody of one operator.

Gisholt Extended Payment Plan

Under an extended payment plan announced by the Gisholt Machine Co., Madison, Wis., any new Gisholt machine can be obtained with an initial down payment of 20 per cent. The balance of the cost may be spread, in equal payments, over 12, 24, 36, or 48 months, depending upon the plan selected. The method also reverses the usual pattern of handling interest charges by starting with the lowest amount and increasing gradually. This method is said to favor the buyer because it gives him the use of more cash during the earlier payments. Also, since the buyer has the privilege of prepaying notes at any time without penalty, he may avoid higher interest payments toward the end of the contract. A bulletin, "What You Should Know About Buying and Renting Machine Tools," is available from the company.

In Shops Around

Camera highlights of some interesting operations performed in various metal-working plants throughout the nation

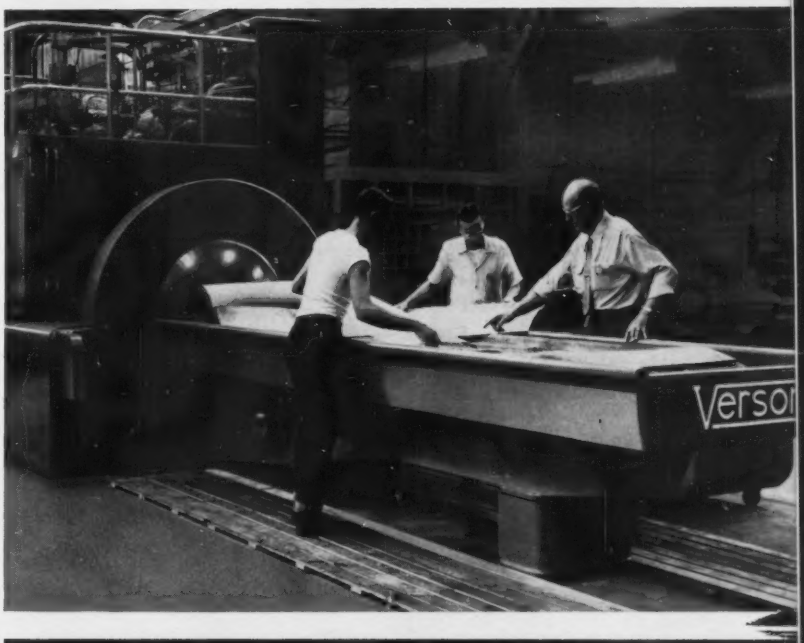


Finished aluminum foil rolls out of new Loewy four-high, 60-inch mill at the Kaiser Aluminum & Chemical Corporation, Permanente, Calif. The 350-ton unit produces foil as wide as 54 inches, and can reduce stock thickness from 0.026 to 0.00025 inch at speeds up to 3000 feet per minute. Valves below control panel direct oil spray to different areas of rolls, preventing overheating and thus assuring uniform foil thickness.

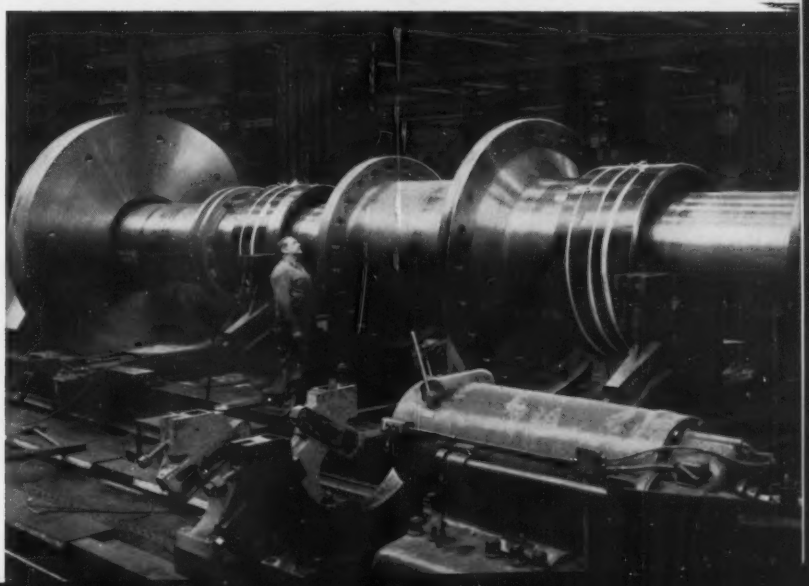
Surface "peaks" and "valleys" from 0.000002 to 0.0001 inch are measured with a Bausch & Lomb interference microscope at the research laboratories of General Motors. The instrument is also used to measure plating thickness and to study the effects of weathering on painted surfaces. A camera located at the top of the microscope photographs the interference patterns.

the Country

First draw of stainless-steel galley tubs for the United States Navy is being performed on a 650-ton H-P-M press at the Polar Ware Corporation, Sheboygan, Wis. Finished tub is 24 inches in diameter at top, 21 inches at bottom, and 18 inches deep. After final draw, tub is rolled at the top, a stainless-steel band is spot-welded on for base, and handles attached.



New Verson-Wheelon hydraulic press at Northrop Aircraft, Inc., Hawthorne, Calif., exerts a force of 19,440 tons. In operation, an inner liner in a chamber is inflated to a maximum pressure of 7500 pounds per square inch against one side of the work blank, forcing it into a form block. The press features a double shuttle working table arrangement. While one table is pressing a part, other table can be loaded, thus affording continuous production.



Machining a 118-ton shaft assembly for a hydraulic turbine-driven generator at the General Electric Co., Schenectady, N. Y. A total of twelve of these hydro-generators are being built for the powerhouse at McNary Dam on the Columbia River. In terms of actual physical size, they are claimed to be the largest pieces of rotating electrical equipment ever manufactured.

Carbide Straddle-Milling Operation on Track Roller Shafts

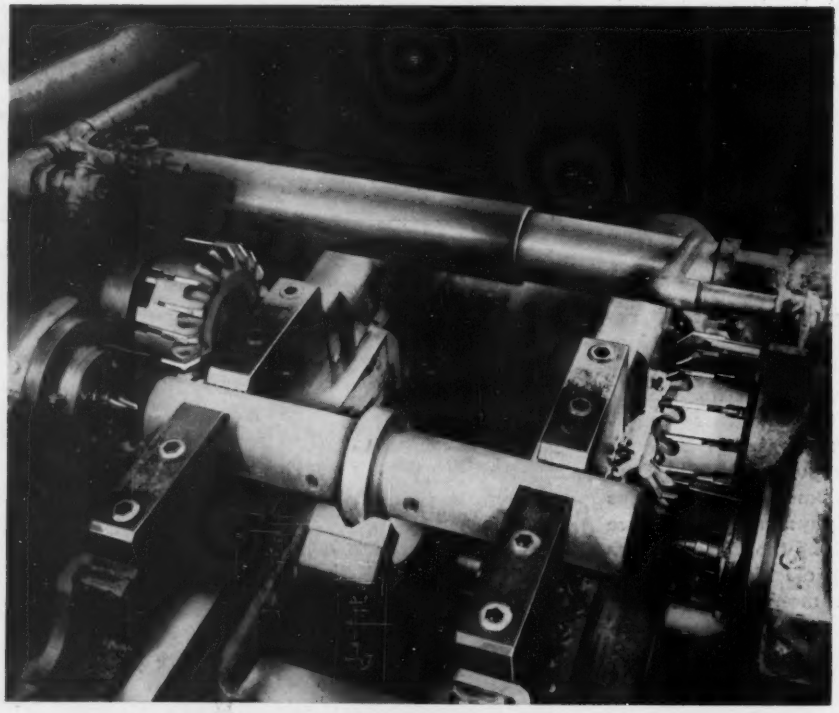
HEAVY-DUTY straddle-milling of track roller shafts in a large Midwestern road machinery plant has been increased from 160 to 600 shafts per grind of the cutters by using Wesson Rigidcut inserted-blade milling cutters. These cutters are provided with Grade WM Wessonmetal carbide-tipped blades. This operation on the forged steel shafts is being performed on Fay automatic lathes set up as shown in the illustration. Cuts are taken on the 4 1/2-inch diameter shafts at a speed of 265 surface feet per minute and a feed of 19 inches per minute. It has been estimated that the use of the new cutters has reduced the grinding time almost 250 hours a year.

The primary object in providing these cutters to replace the carbide cutters previously used was to reduce the horsepower requirements of the operation. The original cutters were made with an axial positive rake of 5 degrees and a radial negative rake of 10 degrees. When the cutters were sharp, 30 H.P. was required and the overload was 20 per cent. After 100 shafts were milled, the cutters required 40 H.P. and the overload was 60 per cent. After milling 166 pieces, the cutters required 45 H.P. and the machine was overloaded 80 per cent.

The new cutters have an axial positive rake of 3 degrees and a radial negative rake of 5 degrees. Each cutter is provided with eighteen blades and has a diameter of 6 1/2 inches. In machining the first 200 shafts, a maximum of 28 H.P. is required and the overload is only 12 per cent. After milling 300 shafts, 30 H.P. is required and the overload is 20 per cent—the same as with the former cutters in the sharp condition.

Track roller bushings are being finished with reamers equipped with Wessonmetal Grade GI solid carbide blades. The operation is performed on automatic chucking machines with the reamers running at 200 R.P.M. The cutting speed is 355 surface feet per minute and the feed is 0.024 inch per revolution. Six thousand bushings are obtained per grind of the reamer.

Straddle-milling operation on forged steel shafts, in which 600 work-pieces are machined before the cutters require resharpening



Technical Papers Presented at A.G.M.A. Meeting

ENLIGHTENING papers concerning both gear-cutting and gear-checking techniques were presented at the technical sessions of the semi-annual meeting of the American Gear Manufacturers Association. This fall meeting was held at the Edgewater Beach Hotel, Chicago, Ill., from October 24 to 27, inclusive.

During a morning session, M. L. Baxter, Jr., chief research engineer at the Gleason Works, Rochester, N. Y., presented a paper entitled "The Unitool Method." While explaining that a group of six "Unitool" cutters will cover the combined ranges of work handled by the company's Nos. 106 and 116 generators, Mr. Baxter emphasized the fact that this method is intended for small quantities and does not replace the highly refined methods presently employed for heavy production. It was also brought out that each of these cutters will not only handle all reasonable tooth designs, including equal-addendum teeth, standard long- and short-addendum teeth, stub teeth, and other tooth forms, but will also handle both the gear and pinion members of the pair.

In his paper entitled "Increased Gear Shaper Production through Chip Flow Control," J. F. Jones, Jr., factory engineer at the Fellows Gear Shaper Co., Springfield, Vt., stated that control of chip flow in gear shaper operations has led, in some cases, to tool life improvements of up to 400 per cent, and production improvements of 100 per cent and more. An additional advantage of this control is that cutting forces are regulated and balanced, leading to improved gear quality under conditions associated with high rates of production. Chip flow control is claimed to be effective because it prevents the chip, which originates at the leading edge of the cutting tooth, from producing excessive pressures at the trailing edge.

According to Mr. Jones, an analysis of the normal distribution of the cutting load showed that the non-cutting edge does less than 5 per cent of the total work, the tip doing the greatest amount of work per unit of cutting edge length. Wear distribution is just the reverse. The least amount of wear occurs at the tip, increasing along the leading edge, and assuming its greatest proportions along the non-cutting, or trailing edge.

The "Probograph" method for the dimensional measurement of gears was the subject of the paper entitled "A Precise Technique for Accurate Checking of Gear Dimensions," presented by W. S. Tandler, president of the Warner & Swasey Research Corporation, New York City. It is a method by which given points on a gear are checked for the coordinate dimensions assigned to them in the drawing. A group of four or more such points on each gear tooth is measured and recorded in the form of small black dots on a strip of graph paper. This record shows the location of the selected points of each tooth, and the extent and direction of the deviation, if any. Indicated are the four basic gear tooth errors—thickness, lead, taper, and spacing. Inasmuch as the coordinated information of all the gear teeth is recorded on the same chart, deviations caused by eccentricity, misalignment, wobble, and similar discrepancies are made evident.

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V-Belt Slide Films Available

A second group in a series of educational 35-millimeter sound slide films has been prepared by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. The three slide films are on the subject of V-belt drives, and each runs about twenty minutes. They are entitled "In Every V-Belt Drive," "For Better Driving," and "Selecting a Drive."

The first slide film, in color, covers the engineering principles that are basic in every V-belt application. The second concerns itself with the installation and maintenance of multiple-V-belt drives. The third tells how to check characteristics to find the best type of drive and then engineer it to do the job. Requests for showings of any of these slide films should be made to the nearest Allis-Chalmers General Machinery Division district office.

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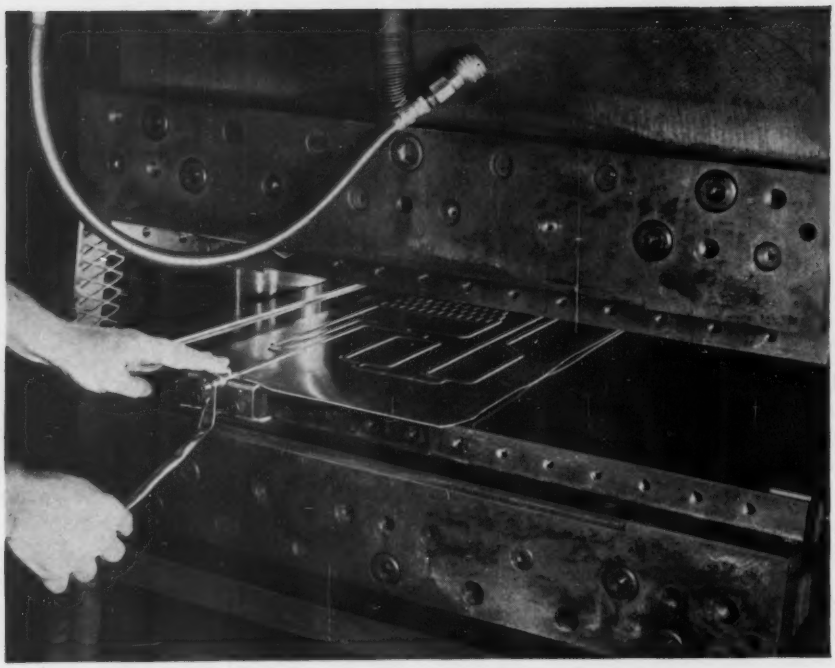
Lincoln Arc-Welding Competition

The James F. Lincoln Arc Welding Foundation has announced its eighth annual competition for engineering undergraduates in the 1954-55 school year. The program offers forty-six awards for papers not more than twenty pages in length dealing with the welded design of a machine, machine part, structure, or structural part. The top award carries a prize of $1250. A Rules and Conditions booklet illustrated with previous designs is available from the James F. Lincoln Arc Welding Foundation, Cleveland 17, Ohio.



Heat-Exchanger Tubes Blown Inside Bonded Sheets

Any pattern of tubing—however intricate—can be created in a single sheet of metal by a new application of the old art of roll bonding

BLOWING tubing into bonded sheets of metal is a process destined to exert considerable impact on many industries concerned with heat exchange. It has been developed by the Olin Mathieson Chemical Corporation after ten years of research. In the refrigeration industry, for example, the process has reduced retooling costs for evaporator plates from $50,000 to $50; cut retooling time from six months to one week; and increased the efficiency of the plate by more than 25 per cent.

The process combines the application of a secret "paint" by means of a silk screen and the fusion of two sheets of metal by the old art of roll bonding. The tubing pattern—and there is no limitation on the intricacy of its design—is first applied to one side of one sheet with the paint. The other sheet is then placed on top of the pattern, and both sheets are spot-welded at the corners to keep them in proper relative position. A hot-rolling operation follows, producing a complete bond of the two sheets, except in the painted areas. Subsequent cold rollings reduce the now homogeneous single sheet of metal to proper thickness, while increasing its length approximately four times.

After an anneal, one end of the sheet is trimmed to expose the lead-in of the pattern, and the sheet is placed between two heavy platens on a press. A hollow needle is inserted in the lead-in and attached to a hose extending from a hydraulic pump. As water is forced through the needle, the pattern becomes inflated. The platens are fixed a slight distance apart, equal to the required external thickness of the tubing section, and thus serve to confine the amount of dilatation of the pattern. In the illustration, the upper platen has been raised and the hose disconnected after pumping has been completed. Then, the paint residue is flushed out with water.

Patterns must, of course, be designed so that they are foreshortened lengthwise, to compensate for the elongation of the metal in cold-rolling. The process can be used with many metals—aluminum alloys, copper, carbon steels, and stainless steels. The tubing is self-inspecting in that any obstruction will block completion of the pattern. It is impossible for the tubing to leak.

Method for Checking the Accuracy of Indexing Devices

By William C. Betz

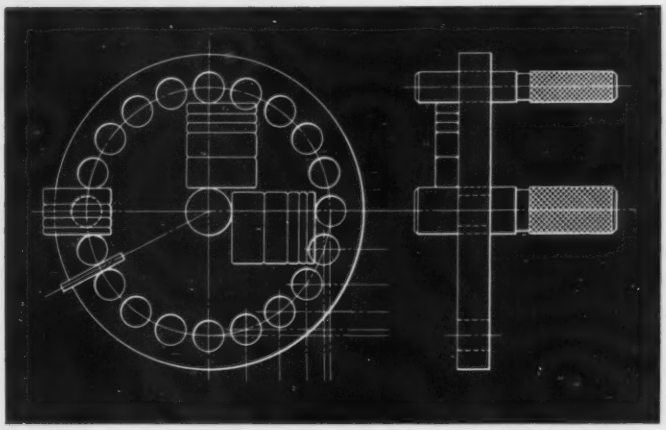


Fig. 1. This view shows how plug gages and size blocks are used to check the circular pitch and radial location of the holes.

To check the spacing accuracy of index-heads and rotary tables, this method has been found useful. It is assumed that these devices are set up on a milling machine. First, a lay-out is made of an even-numbered hole circle on a steel disc. The disc should be approximately 6 inches in diameter and 5/8 inch thick, having a central hole fitting an available arbor. It should be located and fastened over the platen of a jig borer, with the central hole indicated to run true. The hole circle is then machined to a plug-gage fit, using a table of coordinate factors of five decimal places to locate the platen.

Careful measuring with plug gages and size blocks, as indicated in Fig. 1, will disclose any errors in the circular pitch of the hole circle or in the radial location of the holes. Measurements must be within an over-all tolerance of 0.0002 inch.

To check an index-head, the arbor is then pressed through the disc and mounted between the head and its footstock, with a driving arrangement consisting of a faceplate and dog, illustrated in Fig. 2. At this point, the set-up is tested for run-out. With the head indexed so that one of the holes in the circle is on the horizontal center line of the head, an indicator is supported from the milling machine arbor and adjusted to a zero reading over the periphery of a plug gage inserted in this hole. The plug is then removed, and the head indexed to bring each subsequent hole in the circle to the hori-

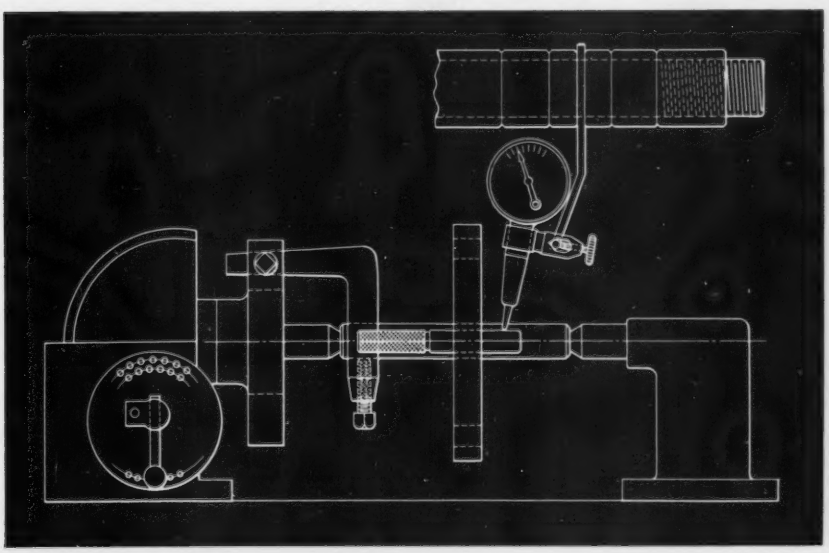
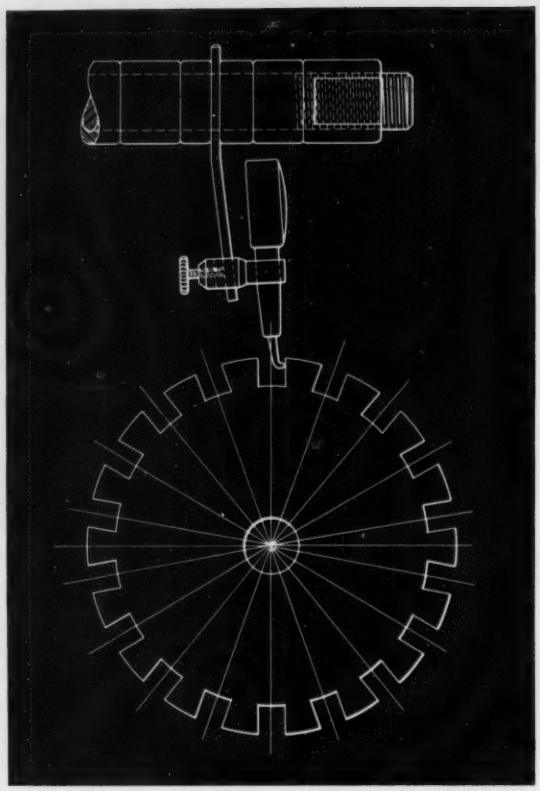


Fig. 2. Index-head accuracy is shown by the reading of the dial indicator on the plug gage when each circle hole is on the horizontal center line of the head.

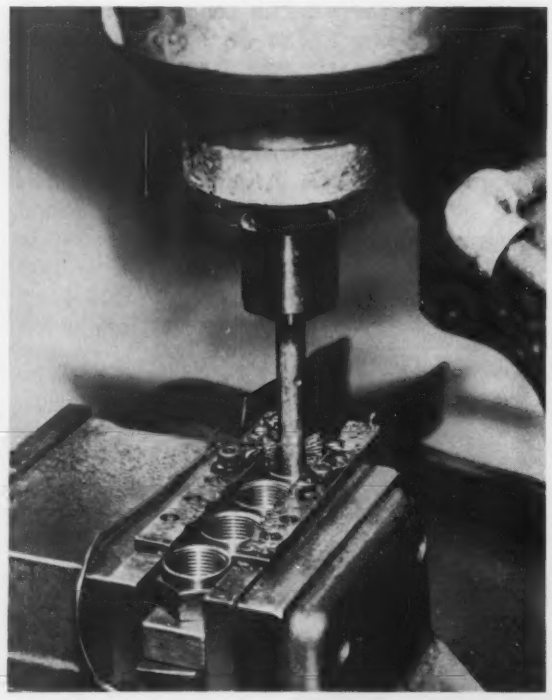
Fig. 3. In this method, the arbor is reversed end for end after milling and before disc is checked with indicator.



zontal center line of the head. Any spacing inaccuracy of the head can be observed in the reading of the dial indicator over the plug when it is inserted in the various holes.

In checking a rotary table, the disc is mounted and trued directly over the center line of the table, which is then indexed so that the central hole and one of the circle holes are aligned with either the longitudinal or transverse feed of the machine. With an indicator bearing against a plug gage inserted in this circle hole, the inspection is performed as before.

An alternate method for checking the spacing of an index-head also employs a disc mounted between centers. Here, slots are first rough-gashed into the disc periphery. Then, the cross-slide of the machine is moved about 0.005 inch, and a finishing cut along one side of the slots is taken completely around the disc. The arbor is next reversed end for end, and a dial indicator is set at zero against the last milled slot slide, as in Fig. 3. Subsequent indexing will disclose the presence of spacing inaccuracies in the head. One disadvantage of this method, however, is that a new disc must be milled for each checking.



Metal chips and small burrs are removed from the threads of coupling nuts by a small power-driven wire brush.

Rotating Wire Brushes Remove Chips from Nuts

The problem of removing steel chips that have become lodged in the threads of stainless-steel coupling nuts, and of removing burrs of various kinds, has been solved by a power brushing method. Small, sturdy wire brushes, made by the Osborn Mfg. Co., Cleveland, Ohio, are mounted on the spindle of a tapping machine. The nuts are fed by hand into a specially built fixture. The brush, which has 0.005-inch diameter stainless-steel wire fill, is fed into the nut at a rate of 100 feet per minute, reversed, and retracted at a rate of 200 feet per minute. As the brush lifts clear, the operator inserts a new nut at the front of the fixture, forcing the completed one out and down an improvised chute. Previously, chips and burrs had to be removed manually.

* * *

"Liquid" Precious Metals

"Liquid" platinum and "liquid" palladium applied as a varnish and reduced to a metal by ceramic firing are used on fine china and glassware for obtaining metallic decorative effects.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Progressive Die Combines Six Different Press Operations

By FEDERICO STRASSER, Santiago, Chile

Economical, quantity production of an electrical component is provided by an eight-station progressive die that combines a variety of press operations. The part, seen in view A of the accompanying illustration, is a support for a lamp socket. It is made of 0.040-inch steel sheet stock. The socket is riveted to the legs of the support which, in turn, has an integral internally threaded hub that screws onto the end of a threaded tube length within the lamp. Except for the thread in the hub, the support is completely formed in the die.

In view B is shown the strip lay-out. At the first station, three small holes are pierced. The outer two, 1/8 inch in diameter, receive the rivets. The central hole, for the hub, is pierced to approximately 11/64 inch. This is one-half of the minor diameter of the thread.

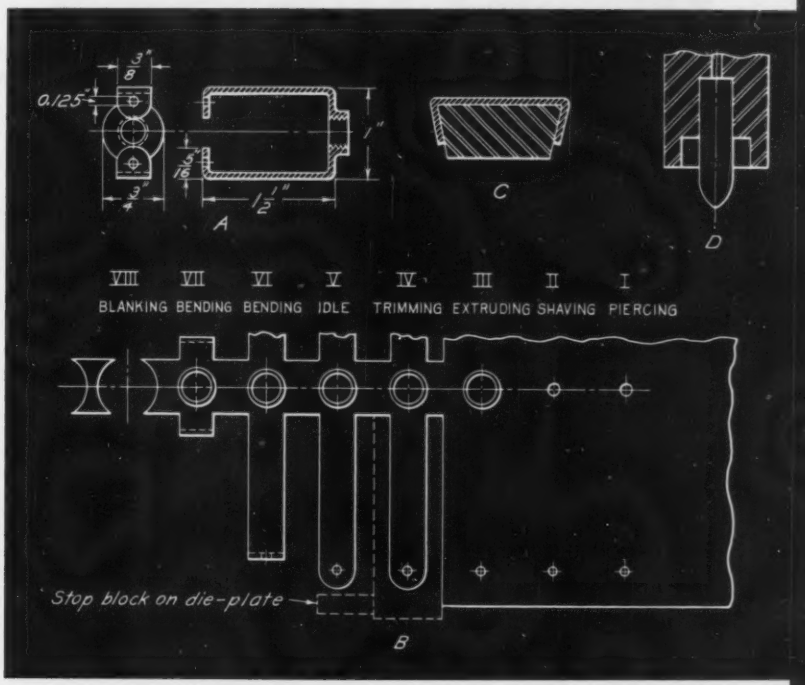
At the second station, the central hole is shaved. This operation produces a clean edge and makes possible a sufficiently long hub. During the shaving, pilot-punches enter the two rivet holes to align the strip.

In extruding the hub at the third station, the flow of the metal is such as to enlarge the central hole and produce a hub length practically three times as great as the initial stock thickness. In order to allow further uninterrupted feeding of the strip, extruding is performed in an inverted manner, with the punch incorporated in the die-plate and the die proper in the punch-holder. This is possible as no slugs or chips are created.

At the fourth station, a trimming punch cuts away stock around the legs of the stamping, also shaping the radius at the ends. The trimming punch extends over one edge of the strip and cuts away an area equal in width to the center distance of the die stations. In this manner, the strip can be advanced after each press stroke until it comes up against a stop-block. At this point it is in the proper position for the subsequent stroke.

To keep the die-plate strong, the fifth station is left idle. At the sixth station, the ends of the legs are formed downward, and at the seventh, the legs themselves are formed. As can be seen in the cross-section of the die-plate at the seventh station, view C, the bending edges taper in a few degrees to compensate for the spring-back of the material.

At the eighth and final station, the central round portion of the hub end is blanked out, and the component is ejected beneath the press table. Concentricity between the blanked profile and



Except for the thread in the hub, component is entirely completed by the progressive die.

the extruded hub is maintained by a pilot on the blanking punch, view D.

A movable stripper is used over the die-plate in order to keep the stock firmly in position during the press stroke. From the fourth to the seventh station, the end of the strip is recessed to accommodate the extruded hub. As can be seen in view D, the blanking punch is also recessed for this purpose.

Indexing Fixture for Milling Thrust Type Washers

By Roger Isetts, Kenosha, Wis.

A bronze thrust washer, used extensively in the production of transmissions for farm tractors, is shown at X in the illustration. Because of the thin cross-section of the washer, clamping is difficult if springing is to be avoided and ample clearance for the cutter is to be provided when milling the oil-grooves. The indexing fixture seen at Y surmounts these obstacles.

Base *A* of the fixture is slotted at both ends for clamping to the machine table. Beneath the base, and in line with the slots, are two keys *B*, their purpose being to align the base with the table. To the top surface of the base is welded a vertical cylindrical member *C*. This upright member is ground on its upper face and reamed to a slip fit with adapter *D*.

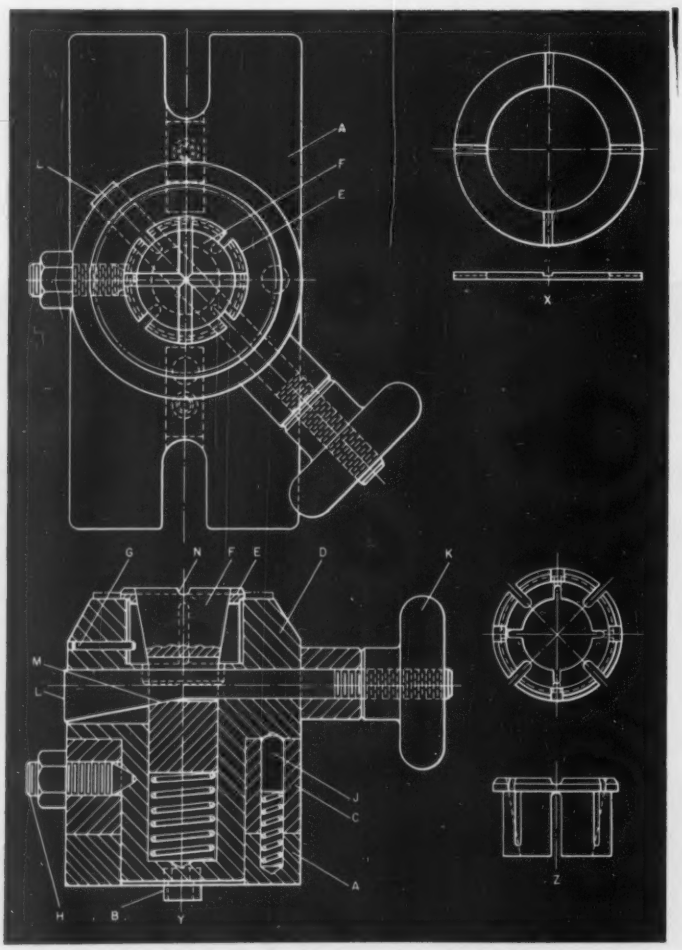
The adapter is counterbored and reamed to receive collet jaws *E* and spring-loaded draw-pin *F*. A detailed drawing of the collet jaws may be seen at Z. Dowel-pin *G* prevents the jaws from turning.

A cone-point set-screw *H* is threaded through the wall of cylinder *C*. The point of the screw extends into a groove that is machined around the adapter shank for a distance equal to a 90-degree arc. A lock-nut retains the screw in position. The rounded end of spring-loaded index-pin *J*, which is housed within the upright cylindrical member, clicks into either of two notches located in the under side of the adapter flange. These notches are located 90 degrees apart and serve as the indexing points for the adapter assembly.

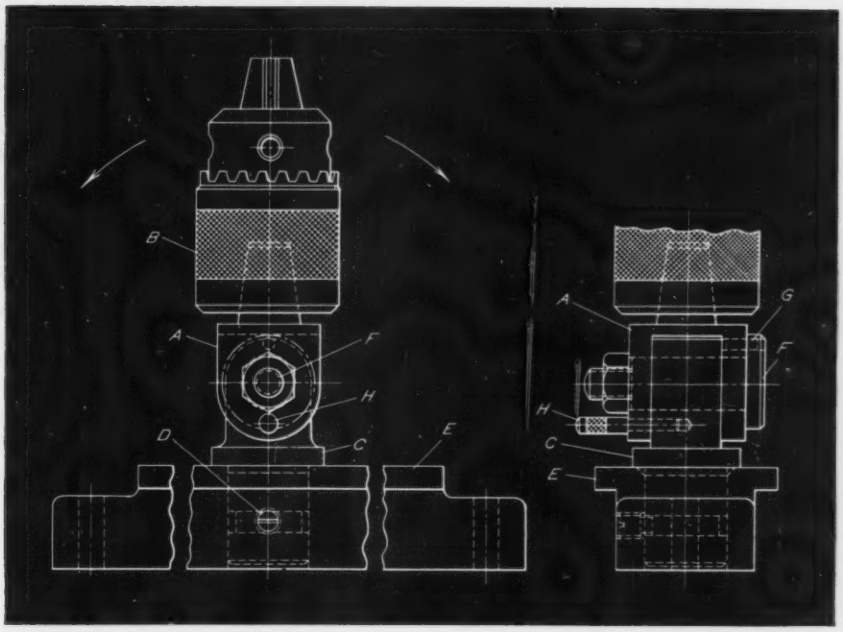
In use, the fixture is first bolted to the machine table, following which a thrust washer is slipped over the collet jaws. Approximately one-half turn of knob *K* will pull draw-stud *L* a distance sufficient to force draw-pin *F* in a downward direction against a spring. This is accomplished through the action of the mating tapers at *M*.

The first pass may then be made, using grooves *N* as a guide for the cutter. When this initial cut is completed, the adapter is indexed 90 degrees, or until index-pin *J* clicks into the second notch in the adapter flange. A second pass may now be made to complete the work-piece.

Unloading the fixture is extremely simple. By backing off knob *K*, draw-stud *L* will move to the left, relieving the pressure on draw-pin *F*. When this happens, the spring beneath the draw-pin will force it up, thereby allowing the collet jaws to spring together to their original position. The thrust washer may then be lifted from the fixture.



Indexing type milling fixture firmly holds the thrust washer shown at X without distorting it. Loading and unloading are rapid.



Work-holding device, constructed around an ordinary drill chuck, may be clamped in a vise or mounted on a machine table.

Drill Chuck Adapted as Work-Holding Device

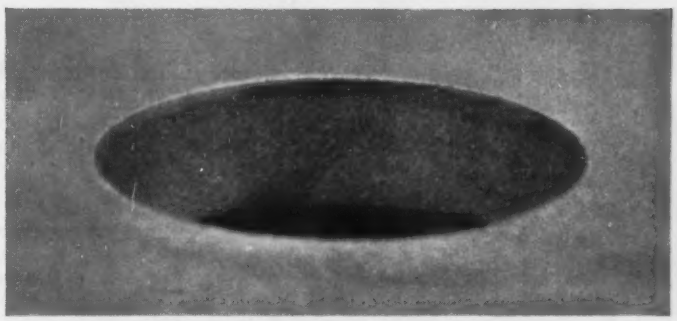
By WILLIAM MORSON, Birkdale, England

A conventional drill chuck may be adapted to hold small work-pieces that might otherwise be distorted if clamped directly in a vise. An example in which a drill chuck is employed for just such a purpose may be seen in the illustration. The chuck is mounted on a movable joint so that it can be swung through an arc of 180 degrees, or 90 degrees to each side of the perpendicular axis, as shown.

Machined on the upper end of steel shackle *A* is a tapered shaft that fits within the mounting hole in drill chuck *B*. The fork at the opposite end of the shackle slips over plug *C*. A set-screw *D*, fitting within an annular groove at the lower end of the plug, secures it in a hole drilled through T-shaped block *E*. With this arrangement, the plug and chuck can be revolved to any desired position in a horizontal plane by merely loosening the set-screw.

The shackle pivots around headed pin *F* and may be locked by means of a standard hexagon nut. Stop-pin *G* passes through the head of pin *F* and into one cheek of the shackle, thus preventing any relative movement between the two parts. The shackle and chuck are accurately positioned in a perpendicular setting by means of a hardened steel locating pin *H*. It is situated in a hole drilled and reamed through the front cheek of the shackle and engages an in-line hole in the adjacent side of the plug *C*. The head of the pin is knurled for ease of gripping.

The T-shaped block *E* may be gripped between vise jaws, the overhanging ledges of the block resting on the top surface of the jaws. It may also be clamped to a machine table by means of strap clamps on the stepped-down ends, or by hold-down bolts passing through holes provided for that purpose in the ends.



Photograph showing fine finish obtainable in cutting a hole through tungsten-carbide by the Sheffield Cavitron ultrasonic process. The material was 1/16 inch thick and the hole 0.250 inch in diameter, the hole having been produced by a trepanning type of tool within an accuracy of 0.001 inch in one pass of the cutter. The abrasive used in the operation was 280 grit. The finish is within 25 micro-inches.

Last Call for Prize Contest on Ingenious Mechanism Articles

MACHINERY is offering $500 in cash prizes for the eight best original articles on ingenious mechanisms to be submitted before January 1, 1955. Each article should be confined to a description of one mechanism or one mechanical movement that has proved its practicability in actual use, and has not previously been described in the technical press.

Here is how the awards shape up:

First prize	$200
Second prize	$100
Two additional prizes	$50 each
Four additional prizes	$25 each

But this is not all. MACHINERY's high-level space rates will be paid not only for the prize articles but also for all other articles that are accepted for publication that may not receive a prize. In other words, although your material may not win one of the eight prizes, you still stand to receive payment for your efforts. Another point—you need not be a subscriber to the magazine.

Forward as many articles as you like. They will all be entered in the competition and may all be accepted for publication—but no contestant will receive more than one cash prize.

The Procedure is Simple

1. Send a drawing of the mechanism (or photograph if preferred—or both) that clearly shows all important parts of the particular movement to be described.

2. Describe as clearly as possible both the *purpose* of the mechanism and its *action—how* it does *what* it does.

3. Mark the important parts on the drawing, such as levers, cams, etc., with letters, *A*, *B*, etc., and use corresponding letters to identify those parts in the description; thus, "Lever *A* is operated by cam *B*." This will help to make the description readily understood.

4. Confine each article to a single mechanism or movement; do not describe an entire machine or refer to parts that do not affect the movement being described.

A Few Helpful Hints for Contestants

Clear blueprints or pencil drawings with distinct lines are satisfactory for illustration. They should be made on separate sheets of paper. Send only drawings that are to scale, with the various parts shown in correct relationship and proportion. Rough free-hand sketches cannot be used. The drawing should show the assembled mechanism, although a diagram may be substituted if it more clearly illustrates the arrangement of a complicated mechanism.

Avoid describing a mechanism that is familiar to most designers; descriptions of movements that are generally known cannot be accepted, even though they may be very ingenious. It is immaterial how long ago a mechanism or movement was designed, provided it has not previously been published.

And Finally, the Mailing Address

Mechanisms Contest Editor
MACHINERY
148 Lafayette St.
New York 13, N. Y.

Bonding Aluminum to Steel

A PROCESS by which pure aluminum, or alloys of aluminum, may be bonded to ferrous metals has recently been made commercially available. "Alumicoat," as the process is called, provides a high degree of protection to steel parts from both chemical and elevated-temperature corrosion. The Arthur Tickle Engineering Works, Inc., Brooklyn, N. Y., commercial licensee for this process, has recently constructed a new building to accommodate the equipment necessary to handle in production quantities both large and small articles. This method of bonding aluminum to steel was developed by the General Motors Corporation under the name of "Aldip."

Although aluminum alloys can be used as the coating material, it has been found that pure aluminum offers greater resistance to the attack of industrial gases and other corrosive media, especially those containing sulphuric compounds. The aluminum, in either case, penetrates the steel to a depth of 0.0015 to 0.002 inch while a protective coating 0.001 to 0.0005 inch thick remains on the surface. Tests have shown that adequate protection against oxidation still remains at temperatures as high as those to which the base metal might be heated during use. At temperatures exceeding the melting point of the aluminum, the coating diffuses into the steel, forming an intermetallic compound of iron and aluminum. This diffused coating acts as a refractory material that provides the steel with maximum protection against high-temperature scaling.

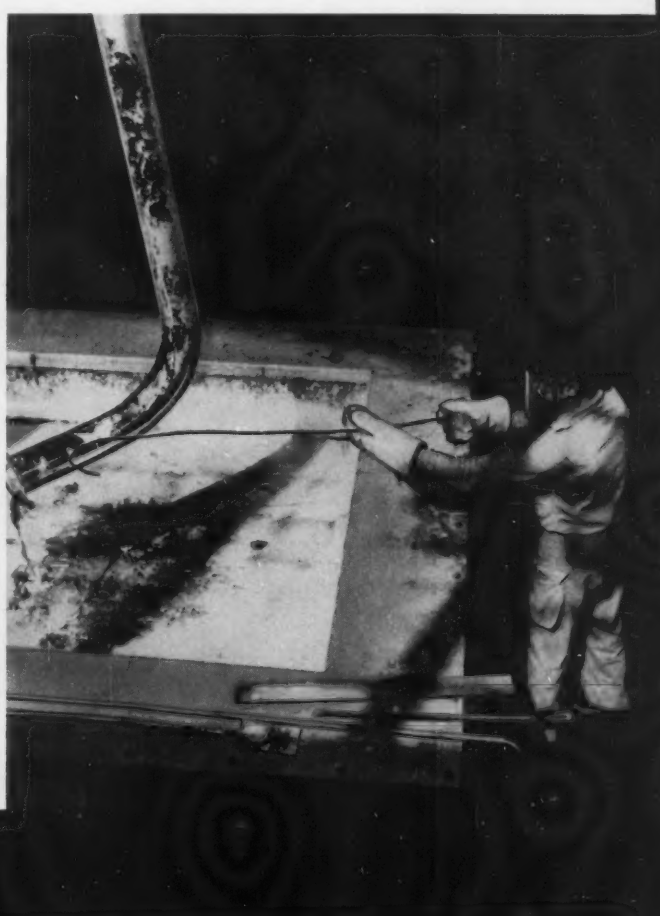
Cleaning in an electrolytic caustic salt bath is the first step in the Alumicoat process. The parts are immersed in this bath, which is maintained at a temperature of approximately 950 degrees F. for a period ranging from one to thirty minutes, depending upon their surface condition. After being removed, the parts are neutralized by lowering them into a bath of dilute muriatic acid. A steam bath follows to remove all traces of impurities from the surface of the metal. All areas to be free of coating are then masked off by painting with titanium oxide carried in a vehicle of sodium silicate and water.

Proper bonding of the aluminum to the steel base metal is assured by submerging the parts in a molten salt bath consisting of sodium chloride, potassium chloride, and cryolite (sodium-aluminum fluoride). This molten flux is heated to an operating temperature ranging from 1300 to 1325 degrees F. in an Ajax-Hultgren salt bath furnace utilizing immersed electrodes. Parts lowered into the heated flux are not only cleaned but also brought up to proper heat for plating.

At the bottom of the furnace is a layer of molten aluminum. The purpose of the aluminum layer is twofold. First, the presence of the molten metal has an advantageous effect on the performance of the flux. Second, small parts may be lowered into the bottom layer for plating rather than into a separate furnace.

A low-frequency induction furnace, shown in the illustration, contains molten aluminum only. It is this furnace into which the hot fluxed parts are lowered for final plating. The aluminum is maintained at a temperature of approximately 1250 degrees F. Since the parts have been preheated to 1300 degrees F. in the flux bath, dipping into the molten aluminum results in a continuous bonded coating upon contact, regardless of part design. Excess aluminum may be removed by rinsing in the flux bath.

The coating of aluminum remaining on the surface may be further diffused into the parent metal by heating it above the melting point of the aluminum. This operation may be carried out to the point where all the surface aluminum will be absorbed by the steel.



Steel engine manifold is raised from a molten aluminum bath and allowed to drain. If further removal of excess plating metal is necessary, the manifold will be given a salt rinse in the hot fluxing bath.

Mill for Bars, Rods,

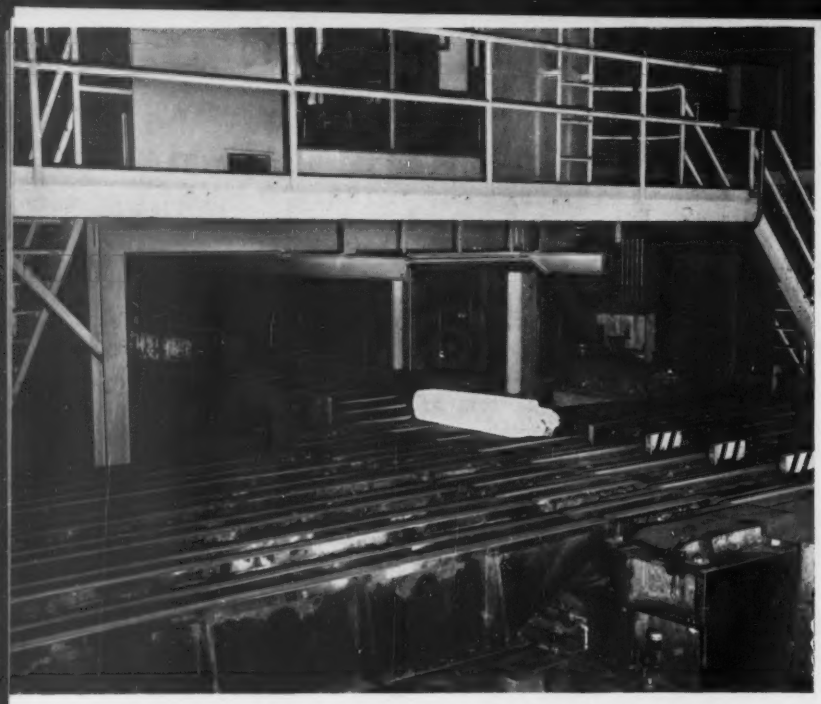


Fig. 1. Ingot from continuous heating furnace is conveyed automatically on a roller table and is shown about to enter initial breakdown mill.

A HOT-ROLLING mill, which for the first time permits the production of strip, rods, and bars on one mechanized combined unit, has been placed in operation by the Carpenter Steel Co., Reading, Pa. The new mill was designed to meet the exacting requirements of producing a wide range of specialty steel products, including tool, stainless, and alloy steels.

In addition to the unique production flexibility provided, this multiple-purpose mill incorporates both the latest developments in automation devices and improved heating facilities that aid in controlling surface decarburization. All bars produced are individually cooled on a notched bar cooling bed prior to annealing to help develop uniform grain structure.

The mill, which covers an area of 125,750 square feet, is equipped with a total of twenty-four mill stands of the following sizes: 10-, 12-, and 14-inch two-high mills; an 18-inch three-high mill; and a 20-inch reversing mill. Strip stock from 1/2 inch to 10 inches wide, having a minimum thickness of 0.093 inch, can be rolled in the mill. Rod coil stock from 1/4 to 13/16 inch in diameter, and bars from 3/8 to 1 1/2 inches in diameter can be produced on the combined installation. Also, ingots up to 14 inches square can be cogged into billets or rectangular slabs for rerolling. Total production capacity of the mill is 3500 tons of specialty steels per month.

The unusual lay-out of the mill provides five finishing points which make possible changing size and shape with a minimum loss of operating time. Also, the arrangement permits rolls to be changed in one part of the mill while operations continue uninterrupted on other stands, thus substantially reducing "down" time during roll changes. Stands are so arranged that they can be used as a train for bar, in tandem for strip, or cross-country and looping for rod production.

Ingots and billets are heated in an oil-fired, continuous furnace equipped with automatic controls. In Fig. 1 is shown a heated ingot after it has just left the continuous furnace and is about to enter the initial breakdown mill, a 20-inch two-

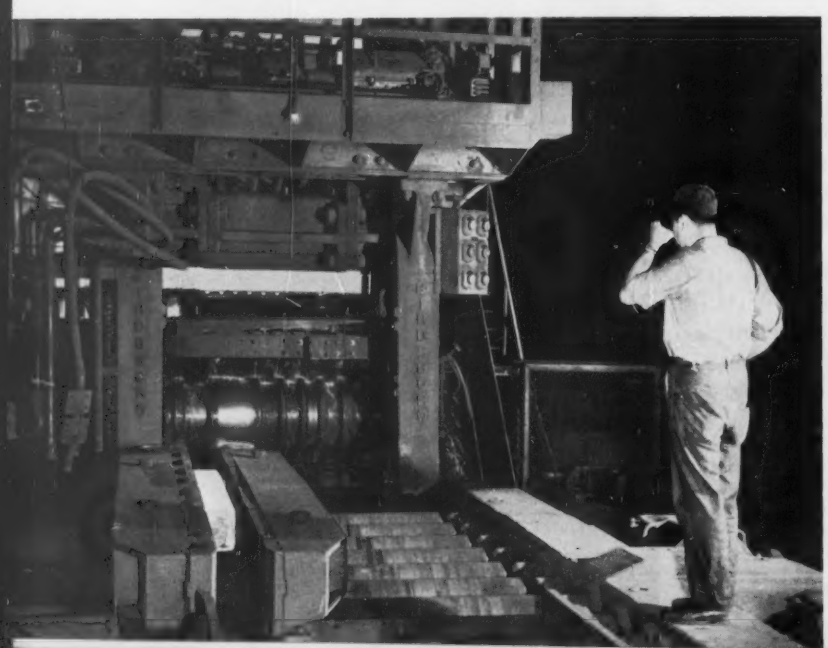


Fig. 2. Exit side of initial breakdown mill. Metallurgist is checking ingot temperature by use of optical pyrometer.

Rolling and Strips

Fig. 3. Over-all view of continuous looping method of rolling rods. Initial breakdown of rods is done at upper left, and finishing of loops in area at right.

high reversing unit. The ingot is conveyed automatically on a roller table. Some of the controls in the first operating pulpit are visible overhead.

A view of the exit side of the initial breakdown mill is seen in Fig. 2. The metallurgist seen at the right is checking the ingot temperature by means of an optical pyrometer. This is but one of many and varied precautions taken in rolling specialty steels to see that every specification is met.

Strip stock proceeds automatically from the two-high reversing mill through various reducing stands before being coiled. Material to be made into bars or coil stock, however, passes through the 18-inch, three-high breakdown mill before going through reducing stands. The continuous looping method used to roll rods is illustrated in Fig. 3. Rod at the upper left is in its initial breakdown, while the loops to the right are in the finishing stages. Compactness of the installation permits close control of size.

Finished rods pass through tubes into the automatic coilers seen in Fig. 4. Completed coils are delivered to a loading point by the conveyor table in the background, each coil moving separately for individual cooling.

Separate drives and motors on each stand in the mill permit rolling within a close temperature range from billet to finished product. Full operation of all stands for the mill requires 9500 H.P. To provide smooth and clean hot-rolled surfaces, and minimize scale pitting, a high-pressure water spray descaling system is used. Scale from the mill is carried to a basin where it settles to the bottom. Clear water overflows into a second basin and is then pumped back into the mill water supply system. Recirculation of the water not only conserves on the supply, but also prevents contamination of the Schuylkill River which flows alongside the mill.

The new mill produces material for Carpenter's own cold-rolling and cold-drawing departments, as well as hot-rolled products for direct sale. Production flexibility of the mill makes it possible to meet the needs for special jobs on short notice, as well as small orders ranging from 1000 to 15,000 pounds.

Fig. 4. Finished rods pass through tubes at lower right into automatic coilers, and are cooled on conveyor table.

The Sales Engineer and His Problems

By BERNARD LESTER
Management Consulting Engineer
New York

Combining Technical Knowledge and Personal Appeal

WHEN any one of us is after a good meal, what kind of restaurant do we choose? The answer is obvious—one that furnishes good, well-cooked food, provides efficient service, and offers a gracious welcome among attractive surroundings.

It is the same with purchasers of industrial equipment. The buyer wants:

Quality products, dollar for dollar.
Efficient technical and commercial service.
An appealing personality with whom to deal.

The companies that sales engineers represent supply products and performance. These are made known through advertising and printed technical data. But the sales engineers must furnish the remaining important elements of skilled engineering and commercial service, and gracious personal appeal.

Recently, two different industrial sales experts were propounding opposing ideas. One expert said, "A good engineer never makes a good salesman. On the other hand, a good salesman can sell anything from cheese to electronic controls." He was a proponent of the philosophy that selling is based on personal appeal. The other expert stuck to the principle that selling technical products to industry "rests almost entirely on an exact knowledge of the product and its application, and on the ability to help the prospect solve his engineering problems economically."

These statements represent the two extremes that constitute properly directed sales engineering effort. Briefly, they are the art of applying technical knowledge toward the solution of the prospect's problems, thereby winning confidence and making oneself necessary; and the art of commanding favorable attention and influencing personal opinion.

If sales engineers are classified into the two types and their characteristics analyzed, it will be discovered that the "technical service" salesman approaches his prospect without trumpet or drum. He gravitates to those who talk his own language and have an eye on objects and figures. His progress is usually slow but his work is sure, and he finally gains the confidence of customers because he solves knotty questions. By being well informed on technical products and processes, he definitely contributes to his customer's success, though he may not fully capitalize on his service.

The "personality" salesman, on the other hand, readily taps the springs of personal contact and thereby establishes good fellowship. He graciously makes people turn toward him with an attitude of good will and favoritism and undoubtedly wins decisions where the margin of advantage is close. His position of favor may be based upon friendship for him, rather than his company. He may, and frequently does, get stymied by technical problems, and must rely on technical help furnished by headquarters—all of which represents time and expense. He may even get tangled up when it comes to fulfilling all statements and promises that he made. Nevertheless, he is often successful by "getting an in" where other salesmen fail.

From observing sales engineers at work over many years, we are convinced that the most successful are those who combine both methods of operation. Many sales engineers lose important orders due to either an inability to establish close personal relations, or to an inability to support such relations through technical service. Again, some sales engineers are unable to apply their technical skills because they cannot readily open up the communicating channels so necessary to their useful application.

If we lift our sights and honestly evaluate our own method of selling, we will probably find that we concentrate unduly upon one or the other of the two sales philosophies mentioned. So often we forget that improvement may come, not by destroying those features of selling that have thus far led to our success, but by rounding them out and extending their scope.

The "born" or "personality" salesman can eventually get more desirable business by acquiring engineering knowledge and skill. The "technical" sales engineer can greatly extend his skill by studying the arts of human contact and communication. As we look at ourselves, we can undoubtedly recognize opportunities for improvement, and then do something about it.

American Welding Society Elects Officers and Makes Awards

Joseph H. Humberstone, president of Air Reduction Sales Co., Inc., New York City, was elected president of the American Welding Society and took office at the thirty-fifth annual meeting held this fall in Chicago. Also elected was J. J. Chyle, director of welding research, A. O. Smith Corporation, Milwaukee, Wis., to the office of first vice-president. Clarence P. Sander, general superintendent, Vernon, Calif., plant of the Consolidated Western Steel Division, United States Steel Co., was elected second vice-president.

Four new directors-at-large were elected. They are E. D. Peters, president and treasurer of the Leader Iron Works; R. J. Yarrow, Consolidated Iron & Steel Mfg. Co.; G. O. Hoglund, Alcoa Process Development Laboratories; and J. L. Wilson, consulting naval architect and engineer.

Outstanding achievements in the field of welding were acknowledged with the presentation of awards during the meeting. William L. Warner, engineering research adviser, Watertown Arsenal, delivered the Adams Lecture under the title, "The Toughness of Weldability." Mr. Warner discussed the significance of toughness on the serviceability of welds and described his work on methods of evaluating this important property.

For the paper judged the most original contribution to the advancement and use of welding, Professor A. A. Toprac, University of Texas, was presented the Lincoln Gold Medal. This medal is awarded annually, being sponsored by J. F. Lincoln, chairman of the board of the Lincoln Electric Co.

A. F. Davis, vice-president and secretary of the Lincoln Electric Co., was awarded the Samuel Wylie Miller Memorial Medal for outstanding contributions toward the advancement of welding. Mr. Davis has been active in the welding industry for forty years. He was elected to receive the Miller Medal this year for his clear vision of the value of welding knowledge, and his generous contribution to the promotion of welding education.

H. O. Hill, assistant chief engineer, fabricated steel construction, Bethlehem Steel Co., was elected an honorary member of the American Welding Society in recognition of his pioneering work in the application of welding to steel structures and faithful service with the Society.

(Left) Joseph H. Humberstone, president of Air Reduction Sales Co., Inc., has been elected president of the American Welding Society.

(Right) A. F. Davis, vice-president and secretary of the Lincoln Electric Co., has been presented the Samuel Wylie Miller Memorial Medal for outstanding contributions to the advancement of welding.

LATEST DEVELOPMENTS IN *Shop*

Barber-Colman Automatic Gear-Hobbing Machine

The Barber-Colman Co., Rockford, Ill., has just announced a completely automatic hobbing machine, tooled for cutting automatic transmission gears at a high production rate. The machine, a horizontal type with a solid over-arm, is designed for maximum rigidity. It operates through a combination of mechanical, hydraulic, and electrical movements.

Feeding and indexing movements and the hob speed of the machine are mechanically governed through a gear train and change-gears. The work-slide, and clamping and arbor-loading movements, are hydraulically operated, while cycling and rapid traverse are electrically actuated. Automatic loading of the work is accomplished through a vibratory hopper feeding system.

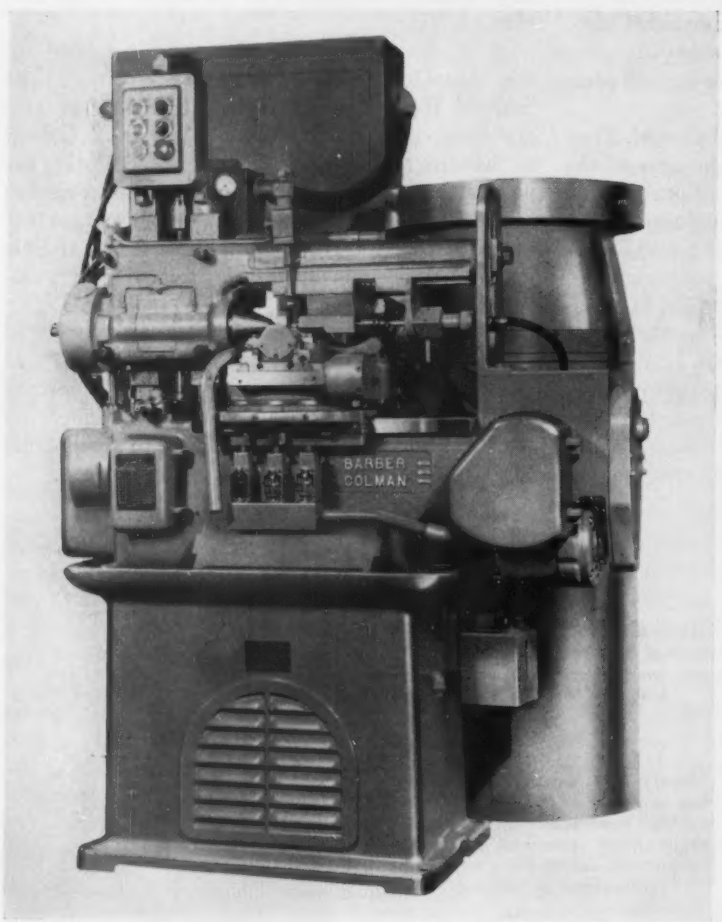


Fig. 1. Automatic gear-hobbing machine placed on the market by the Barber-Colman Co.

In complete cycle sequence, the blanks are first loaded and clamped in the cutting position. The hob is then rapid-traversed to the cutting position and the work-slide lowered to cutting depth. The gear is next hobbed, after which the work-slide is raised to clear the hob. The hob is subsequently rapid-traversed away from the cut, and the finished gear ejected. A new blank is loaded and the cycle is repeated until the machine is stopped by the operator.

One of the tooling features of this machine is the hydraulically operated hob shifter, which greatly increases the cutting life of the hob while eliminating the necessity for manually moving the hob to new cutting positions. This shifter moves the hob to a new position after each gear is cut. Shifts are made automatically in increments best suited for the operation.

Another feature of the machine is the metered hydraulic pressure control that assures positive arbor mounting and ejection of the finished gear. The blanks are loaded on a solid work-arbor to provide positive control of gear accuracy. This arrangement eliminates the chance of looseness, run-out, or vibration.

A combination of electric limit switches and a program motor governs the automatic cycle. This arrangement is adaptable to many similar long-run gear cutting operations within the general range of gears having a diametral pitch of 16, or finer, depending upon the particular gear specifications and

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

production requirements. The cycle is arranged to suit the requirements of the job. Tooling, feed, speed, and cycle timing depend on the required production and the gear specifications.

Clovis Black Granite Surface Plates

The addition of Clovis black granite surface plates to its line of precision equipment has been announced by the Challenge Machinery Co., Grand Haven, Mich. These surface plates are composed of "deep earth" granite finished by a special rotary honing process. They are of a pureness, grain, and density rated as Class A by the National Bureau of Standards. Equivalent Rockwell C ratings show this type granite to be harder than hardened tool steel.

This granite is non-metallic and inactive. It is, therefore, non-magnetic in effect on the most delicate of instruments. The frosted, distortion-free surfaces of these plates permits work placed upon them to be easily moved for accurate positioning, giving a natural release of the air seal to prevent sticking, wringing, or vibrating even in the case of tall gages.

These black granite surface plates are available in twenty-four standard sizes, from 9 by 12 by 3 inches to 72 by 144 by 16 inches, and may be obtained without ledges or with two to four ledges.

Circle Item 101 on postcard, page 245

Remote Control Balancing Machine

All controls and unbalance indicators can be located at any distance from the body of a new static-dynamic balancing machine developed by the Tinius Olsen Testing Machine Co., Willow

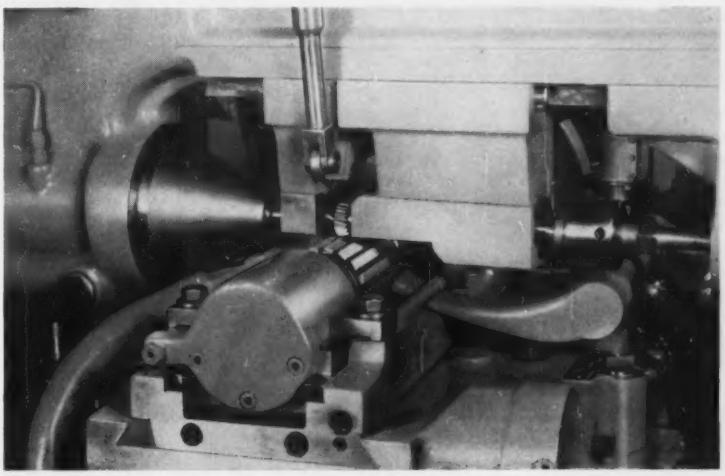


Fig. 2. Close-up view of gear being cut on automatic machine shown in Fig. 1

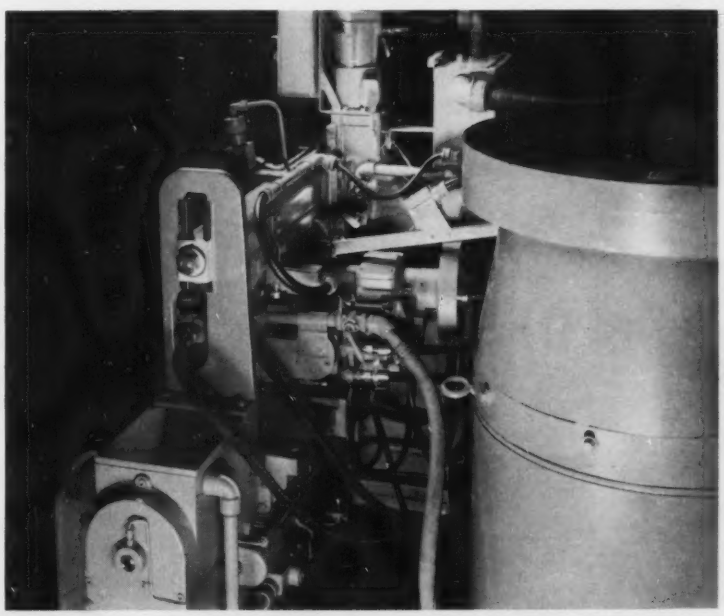


Fig. 3. Close-up view of automatic loading mechanism of Barber-Colman machine, showing chute (in center foreground) that feeds gear blanks to the hydraulic arbor-loading mechanism

Grove, Pa. The amount and angular location of unbalance in the work-piece are indicated on two meters by the highly sensitive Electodyne electronic indicating system. Voltage take-offs are provided so that a permanent record of the unbalance readings can be made on electric typewriters.

Circle Item 102 on postcard, page 245

Reed-Prentice Automatic Injection Molding Machine

A low-pressure die-closing attachment that assures positive mold protection is an outstanding feature of a new 4- to 6-ounce plastic injection molding machine announced by the Reed-Prentice Corporation, Worcester, Mass. A battery of these machines equipped with the attachment can be operated on fully automatic cycles by one attendant.

The machine is designed for rapid molding of small thermoplastic parts, and is capable of ten dry cycles per minute, or 600 per hour. It develops 175 tons positive mechanical clamping pressure and has a mold stroke that is adjustable between 5 and 8 inches. The die-plates measure 22 by 24 1/4 inches and will accommodate molds up to 24 1/4 by 13 inches. The rated projected casting area in the mold is 75 square inches. Maximum mold thickness is 14 inches and minimum thickness, 6 inches. Use of a stuffing arrangement and multiple strokes permits the machine to be employed for making "shots" of 6 ounces or more.

The heating cylinder has a plasticizing capacity of 75 pounds per hour and is equipped with ceramic heating elements. Dual proportioning type pyrometers accurately control the heater temperature. The feed hopper holds a 200-pound plastic material drum at an angle of 45 degrees. Safety doors at the front and rear are hydraulically and electrically interlocked.

Circle Item 103 on postcard, page 245

Bullard Vertical Turret Lathe and Horizontal Boring Mill

Completely redesigned lines of Model 75 Cut Master vertical turret lathes and Model 75 table type horizontal boring, milling, and drilling machines are presently being introduced by the Bullard Co., Bridgeport, Conn. The machines were given this model number to mark the seventy-fifth anniversary of the concern.

A unique feature of both lines is a pendant station that incorporates the use of directional levers instead of push-buttons for ease and safety of operation. Speeds and feeds are quickly obtained through dials on the side of the station. The entire control unit has a built-in elevating mechanism so that it can be automatically adjusted to a convenient height for the operator.

The table of the vertical turret lathe is supported on a new type of combination radial and thrust roller bearing which permits greater accuracy at high speeds. Slides and swivels are of square lock-gib construction, and the ram body is octagonal. Traverse shafts rotate only when functioning.

Another interesting innovation is the ability to interchange the Cut Master between manual and

Automatic injection molding machine of improved design made by Reed-Prentice Corporation

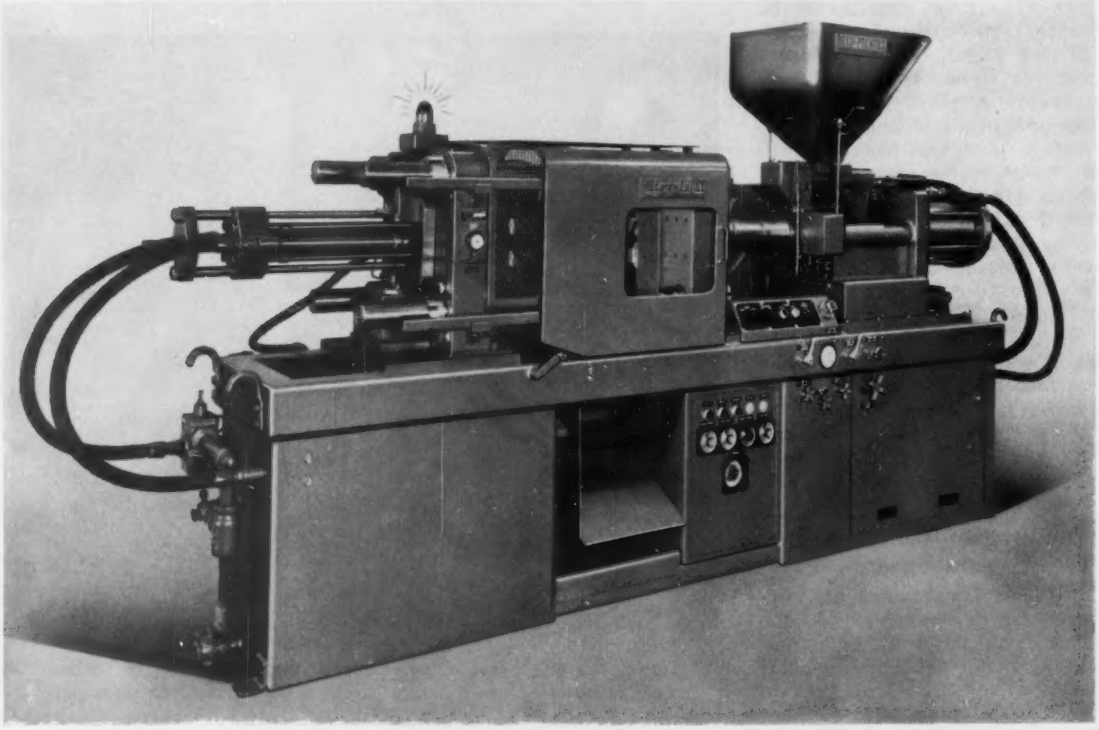
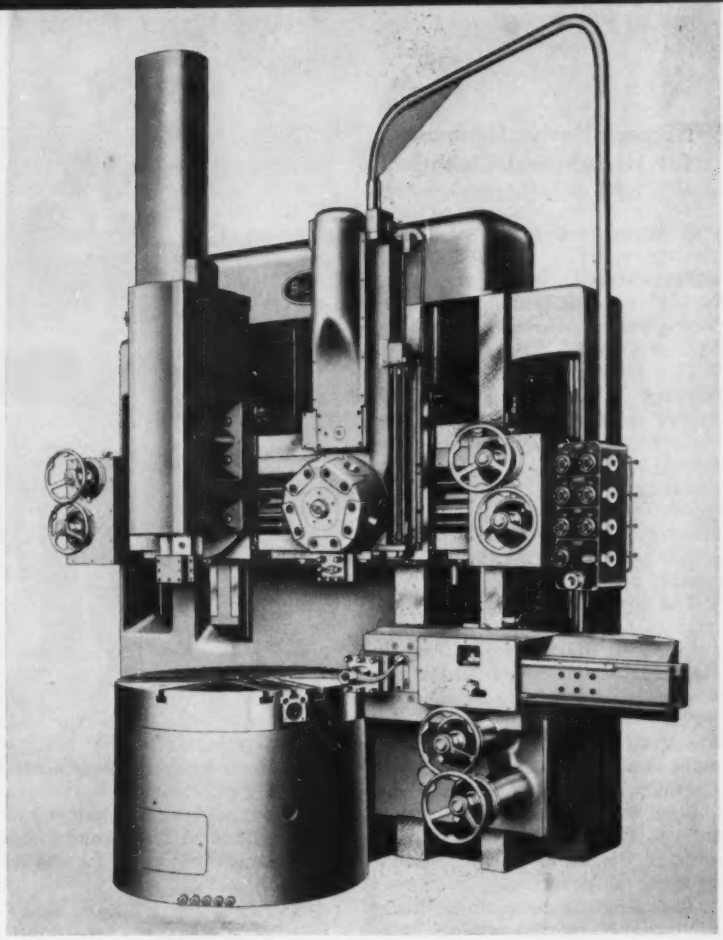


Fig. 1. Bullard Model 75 Cut Master vertical turret lathe



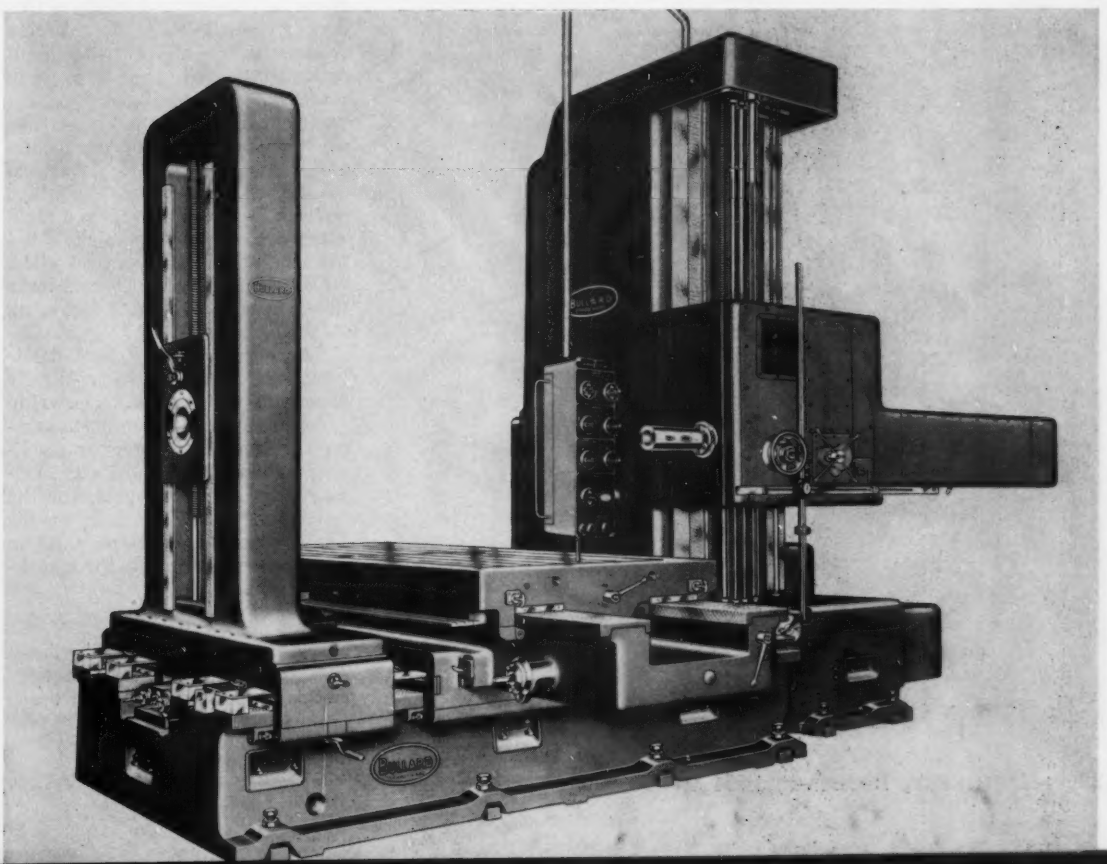
completely automatic operation by the installation of Bullard's Man-Au-Trol attachment. Other attachments available include a hydraulic chucking mechanism, a variable-speed drive, and angular turning, thread-cutting, and drum scoring devices. The lathe is built in table sizes of 26, 36, 46, 56, 66, and 76 inches, with a variety of head combinations.

The feed dial on the pendant station of the boring mill registers in inches per revolution as well as inches per minute. With both a screw and a rack feed available for the spindle, there is ample power for boring and also a sensitive hand feed action for light drilling and tapping.

A built-in optical measuring device is provided for the head and table, enabling the operator to set the head or table to any desired position quickly and accurately. These machines are available in spindle diameters of 3, 4, and 5 inches, with a wide range of bed lengths and table sizes.

Circle Item 104 on postcard, page 245

Fig. 2. Bullard Cut Master horizontal boring, milling, and drilling machine with optical measuring device for table and head

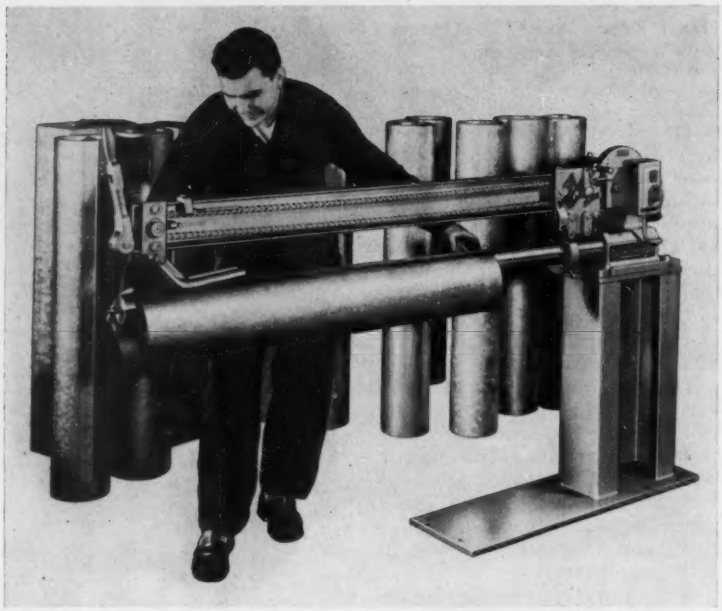


Niagara Power Groover for High-Speed Closing of Lock Seams

A Model 48-U universal power groover with interchangeable horns and rolls, built for closing both single lock seams and Pittsburgh lock seams, has been manufactured by the Niagara Machine & Tool Works, Buffalo, N. Y. This power-driven groover is designed to reduce operator fatigue while eliminating the noise and delay often experienced when using hand tools. The conveniently located controls of this new power groover have been designed to provide fast operation and increased production.

The nominal working length capacity is 48 inches. Adjustable stops are provided to hold work stationary on the horn. Rolls are mounted in swinging cradles to permit front roll engagement on the outstroke and rear roll engagement on the return stroke. Adjusting wheels are designed to enable close regulation of roll pressure to conform with the thickness of the material to be lock-seamed.

The single lock-seaming horn can easily be rotated and locked in any one of three positions for grooving inside seams or turned to the flat side for grooving outside seams. Widths of grooves in the rolls and horn for single lock seaming are 3/8, 1/2, and 5/8 inch, while the horn for Pittsburgh lock seaming has a groove width of 7/16 inch.



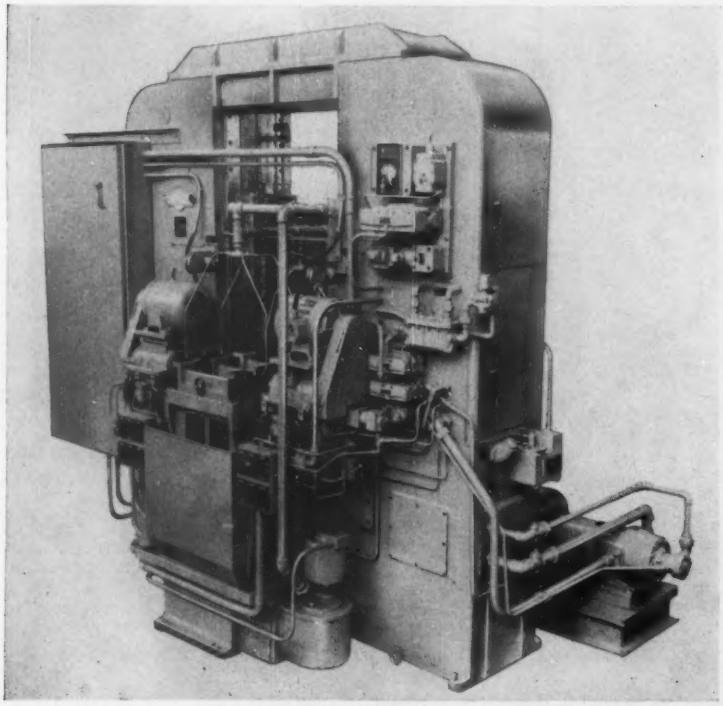
Power groover brought out by the Niagara Machine & Tool Works

Circle Item 105 on postcard, page 245

Combination Broaching and Centering Machine

A special machine, designed to broach and then center-drill the ends of automotive main transmission shaft forgings, two at a time, has been brought out by the American Broach & Machine Co., a Division of Sundstrand Machine Co., Ann Arbor, Mich. This machine consists essentially of two standard vertical hydraulic broaching machines, each of 10-ton work capacity and with a broaching stroke of 36 inches, mounted on a common center base. The vertical columns of the machines are joined at the base and top to form a rigid integral unit. On the table is a hydraulically operated lateral slide, which moves the fixture and locks it at the broaching and centering stations.

The two-station fixture holds two parts, which are hydraulically clamped. Adjustable centering jaws that clamp these parts compensate for eccentric wear conditions. Four drilling units are employed, two on each side, for the centering operation. A hydraulic feed is used to move the units in and out of position at the center-



Special machine developed by the American Broach & Machine Co. to machine two shaft forgings at the same time

ing station. Separate electric motors rotate the centering drills.

The operator loads two parts in the fixture and pushes an electrical control button to start the cycle. The parts are automatically clamped and moved into the broaching position. Surface broach sections, approximately 30 inches long, move down, broaching approximately 1/4 inch of stock from each end of the forged parts. The slide then moves back to the centering station, where four center drills simultaneously move in to center-drill the ends of the two parts. The parts are then unclamped, allowing the operator to unload the machined work, thus completing one cycle. The machine cycle requires about eleven seconds, which gives an approximate production of 300 parts per hour.

Circle Item 106 on postcard, page 245

Device for Automatically Controlling Gear-Making Machines

Automatic operation of entire gear production lines has been facilitated by a further development of the automatic three-way gear selector, announced by the Michigan Tool Co., Detroit, Mich. in May, MACHINERY, page 235. This gear selector makes it possible to automatically grade and separate gears into their correct, over-, and under-size classifications. With the new development, the former gear selector becomes a "machine controller" by automatically readjusting the machine any time it produces an over- or under-size gear. The device can be applied to such equipment as gear finishing, hobbing, and shaping machines.

Although of simple design, the device is so sensitive that it will correct machines for dimensional errors caused by tool wear and even by changes in temperature during the day. Should a certain percentage of over- or under-sized gears be produced within a given time, as might occur when tool wear has become pronounced, the device automatically shuts off the machine, signaling the line operator that specific tools need sharpening or that the machine needs some other form of attention. Correct gears are passed on to the next operation. The device is equally applicable to machines producing spur or helical gears.

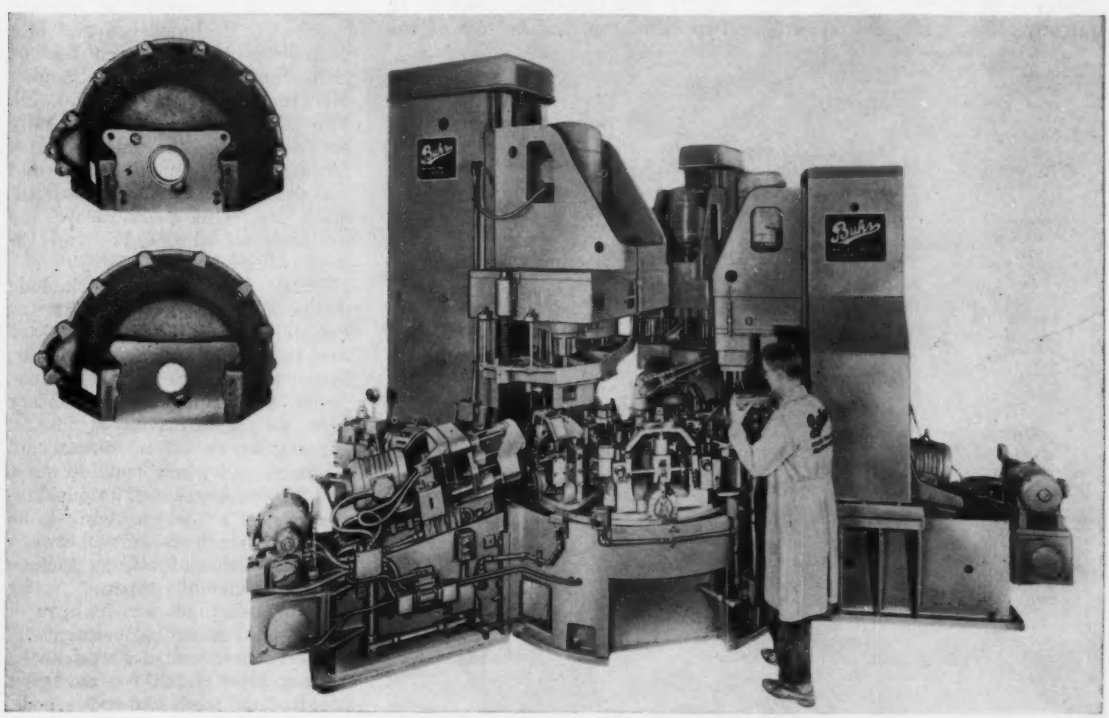
Circle Item 107 on postcard, page 245

Special Machine for Processing Automobile Flywheel Housings

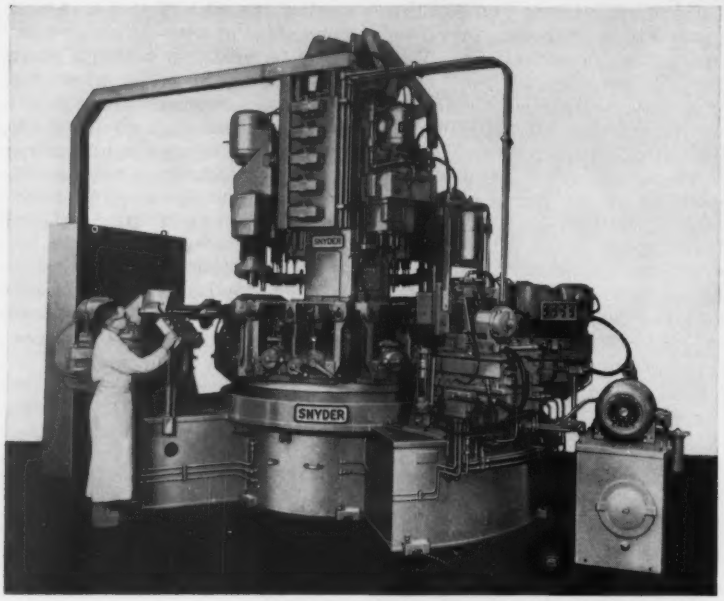
Automobile flywheel housings requiring forty-two operations are being processed at the rate of ninety-nine an hour by a special machine brought out by the Buhr Machine Tool Co., Ann Arbor, Mich. This machine is of the hydraulic-feed, automatic indexing dial type, with five stations equipped for multiple drilling and lead-screw tapping. Operations performed by the machine include drilling, reaming, countersinking, rough-boring, and tapping.

The power-operated automatic index-table is completely equipped with a shot type lock-bolt. Fixtures are clamped and unclamped hydraulically. The machine has hardened and ground laminated tool-steel ways; multiple heads equipped with ball bearings; and threaded parts that are precision ground and hard chromium-plated. The electrically controlled automatic index mechanism insures uniform acceleration and deceleration of the indexing movements. Hydraulic and electrical installations are designed to J.I.C. standards.

Circle Item 108 on postcard, page 245



Automobile flywheel housings processing machine of special design built by Buhr Machine Tool Co.



Special-purpose automatic machine built by Snyder Tool & Engineering Co. for machining transmission parts

Snyder Machine for Processing Automotive Transmission Parts

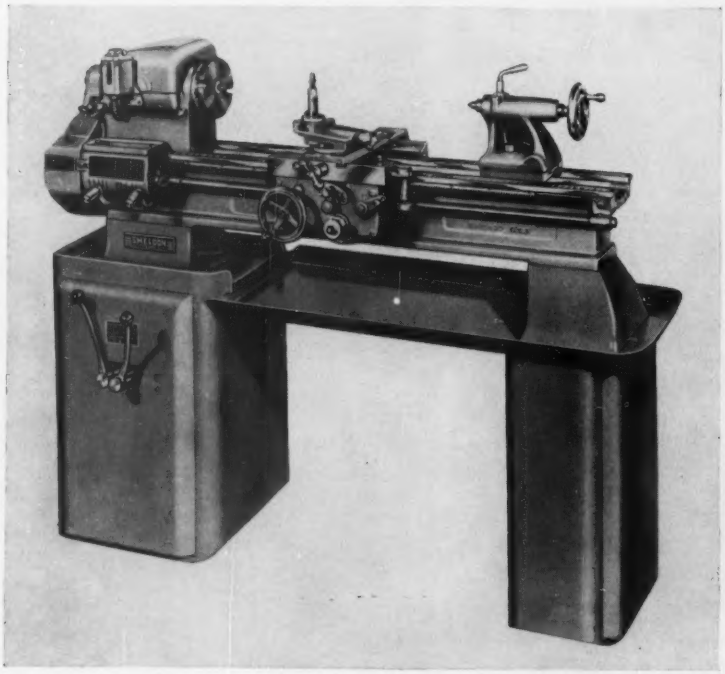
An automatic cycle, special-purpose machine for processing rear bearing retainers on automotive transmissions is announced by the Snyder Tool & Engineering Co., Detroit, Mich. This is a six-station, center column machine with vertical and horizontal units and an index-table. It performs drilling, reaming, spot-facing, chamfering, and tapping operations on two sides, top, and bottom of the part. The work-piece is cast iron and production is at the rate of eighty pieces an hour with the machine operating at 80 per cent maximum efficiency.

The two-position, pump jig type fixture is manually operated. The work cycle is automatic, and the machine may be operated by semi-skilled help. Electrical interlocks safeguard both the operator and the machine.

The high-speed steel tools and tungsten carbide-tipped cutters are properly guarded. Drills are operated at a speed of 80 surface feet per minute. The cutters have an in-feed of 6 inches per minute and taps run at a speed of 30 surface feet per minute. Reamers operate at a speed of 40 surface feet per minute with an in-feed of 3 inches per minute.

Heads are mounted on standard hydraulic slide units, each unit having its own electric motor. The index-table is mounted on roller bearings and is hydraulically operated. The hydraulic tank is a separate unit mounted beside the machine.

Circle Item 109 on postcard, page 245



Improved lathe with new pedestal announced by the Sheldon Machine Co., Inc.

Sheldon Lathes of Improved Design

A newly designed pedestal is a feature of the improved line of lathes announced by the Sheldon Machine Co., Inc., Chicago, Ill. The heavy cast-iron pedestal fully encloses the motor and drive. A large storage space for tools and accessories is provided in the tailstock leg. This pedestal will be available on all 10-, 11-, and 13-inch swing lathes.

Other improvements include double neoprene cog V-belts for the spindle drive. These belts are said to have greater pulling power, longer life, and greater resistance to oil, heat, and static. A safety type switch prevents accidental turning on or off of power and Formica end gears provide quiet and safe operation. The illustration shows a 13-inch swing lathe with a 34-inch capacity between centers. Other features include "zero precision" tapered roller spindle bearings which have a single take-up for adjustment.

The double-walled apron has a friction disc clutch for engaging longitudinal feeds and cross-feeds. The gear-box provides for cutting threads of fifty-four different pitches, including many special

threads. Rapid selection of pitches and feeds can be made while the lathe is running.

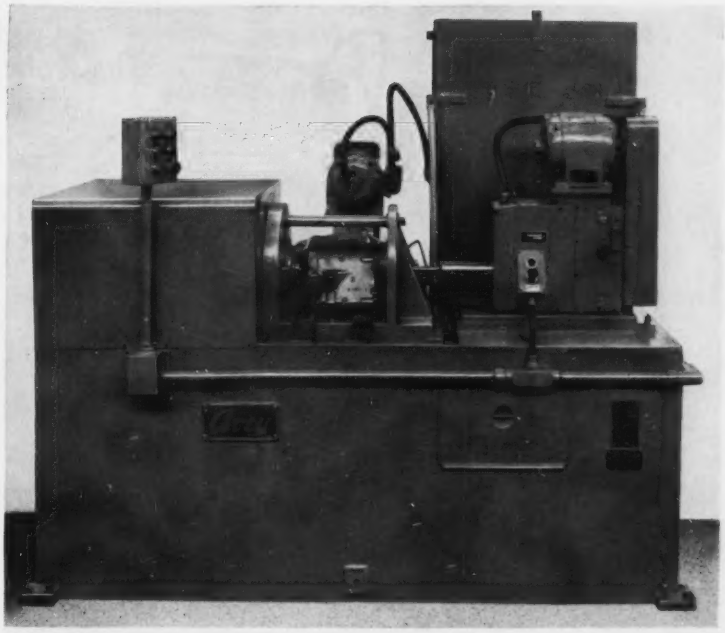
Circle Item 110 on postcard, page 245

Avey Automatic Bushing-Inserting Machine

The Avey Drilling Machine Co., Inc., Cincinnati, Ohio, has built four automatic brushing-inserting machines, one of them being here illustrated. This machine performs three operations: it presses a steel bushing into a transmission case; reams the inserted bushing; and drills two small holes for a nameplate.

The machine utilizes two Avey cam-feed units and a hydraulic cylinder, all of which are mounted on a fabricated steel base. All operating units are interlocked through a J.I.C. electrical control panel. Each machine has a production rate of 360 parts per hour at an operating efficiency of 100 per cent.

Circle Item 111 on postcard, page 245



Automatic bushing-inserting machine built by Avey Drilling Machine Co., Inc.

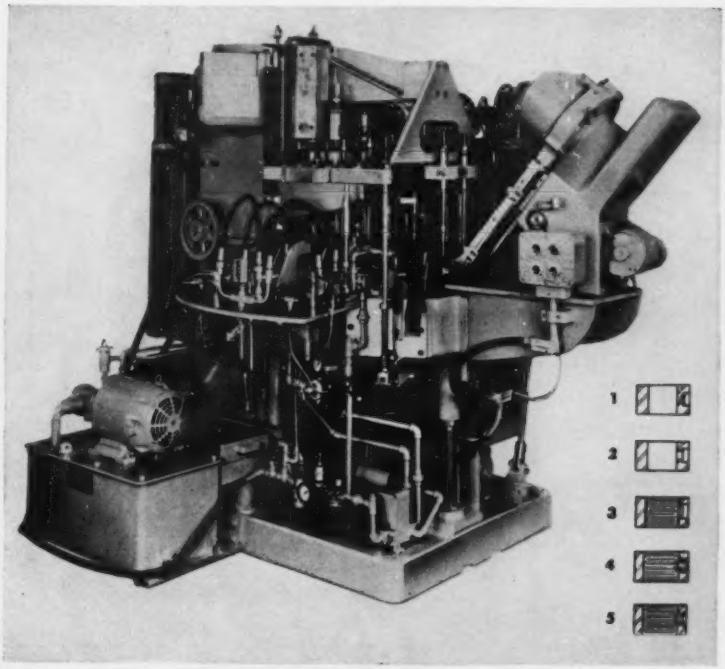
Automatic Drilling, Tapping, Assembling, and Inspecting Machine

"Nylok" lock-nuts, which are similar to a standard hexagonal nut except that they contain a round slug of nylon that passes through one flat face of the nut, can be automatically drilled, tapped, assembled, and inspected on a specially equipped machine built by the Bodine Corporation, Bridgeport, Conn. The slug is staked in place with the inner end of the nylon extending just beyond the minor thread diameter of the nut. When the nut is threaded onto a bolt, the nylon is forced to flow into the threads of the bolt as it compresses the nylon slug, securely locking it to the bolt.

All necessary machining and assembling operations on the cold-headed nut blanks are performed on a standard Bodine Model 48-30, dial type, drilling and tapping machine equipped to perform the required operations in their proper sequence. The nuts range in size from 1/4-28 to 1/2-20 (standard hexagonal nut blanks, Type E). The nut blanks are dumped into a Bodine nut hopper having a double track feed. They are then automatically fed, positioned, and transferred to the dial at the rate of two nuts per stroke of the machine. All operations are performed in duplicate, hence the machine completes two nuts per cycle.

A unique feature of the machine is the incorporation of electrical inspection devices at various stages of the processing, to inspect for a broken drill that might occur in drilling the side hole, and also to inspect for the proper cut-off, insertion, and staking of the nylon slug. One operator can run a battery of three machines. Production rates per machine vary from 1400 to 3000 pieces per hour.

Circle Item 112 on postcard, page 245



Bodine machine equipped for automatic production of "Nylok" lock-nuts

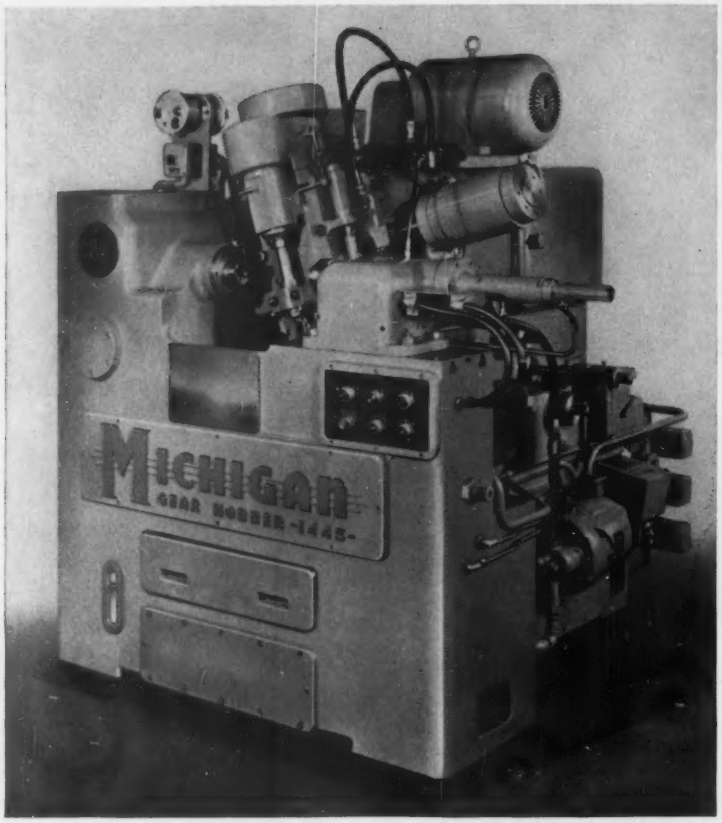


Fig. 1. Michigan "Ultra-Speed" gear-hobbing machine for high-speed hobbing of both spur and helical gears

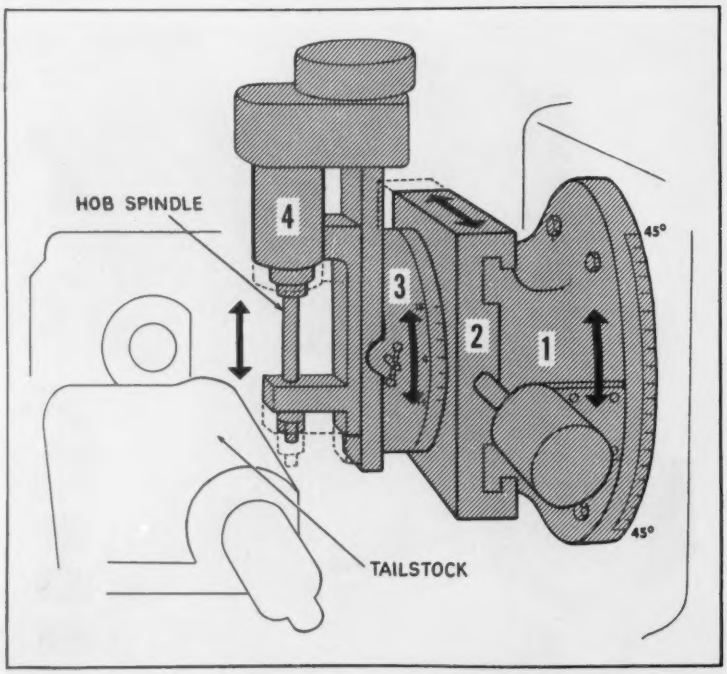


Fig. 2. Spindle head of Michigan hobbing machine, consisting of four sections, with adjustments indicated by heavy arrows

Michigan "Ultra-Speed" Gear-Hobbing Machine

A Model 1445 "Ultra-Speed" gear-hobbing machine is being released to the metal-working industry this month by the Michigan Tool Co., Detroit, Mich. This is the second member of the "Ultra-Speed" gear-hobbing machine line, but it is not a copy of its predecessor, the Model 1458. Although retaining high-production characteristics of this model, such as the "plunge" cutter feed and the automatic work-holding tailstock, it has several advanced major engineering changes.

The Model 1445, single-spindle hobber will machine both spur and helical gears at selective variable cutter speeds ranging up to 570 R.P.M. It will handle up to 8 diametral pitch gears, having diameters as large as 5 inches and face widths up to 4 inches. Either climb or conventional hobbing methods can be employed.

Three separate adjustments have been incorporated in the hobbing head to increase its versatility. These adjustments apply to the hob thread—hob thread angle, gear helix angle, and hob position shift. The head can quickly be set up for hob angles of plus or minus 15 degrees and left or right helix angles up to 45 degrees. The hob position can be shifted hydraulically over a range of 3 inches.

The spindle head has a hydraulically actuated cross-feed that drives the hob across the work at the desired helix angle. This eliminates the need for change-gears and time-consuming calculations. Referring to Fig. 2, the left- or right-hand helix angles up to 45 degrees are quickly set on the vernier scale adjacent to the swivel-plate of Section 1. Section 2 contains the moving portion of the cross-feed—the hob is fed across the work-piece, not vice versa as on conventional hobbers. Plus or minus hob thread angles up to 15 degrees are set on the swivel-plate belonging to Section 3. Section 4, containing the hob spindle, provides for automatic hob position shifting over a total movement of 3 inches.

With this machine, an eighteen-tooth, 16 diametral pitch gear 2 1/2 inches long, having a pitch diameter of 1.169 inches and a helix angle of 15 degrees 46 minutes, is produced in two minutes thirty-six seconds.

Circle Item 113 on postcard, page 245

Zagar Pallet Type Transfer Machine

Zagar Tool, Inc., Cleveland, Ohio, has built a pallet type transfer machine designed to drill, ream, and tap holes of different sizes located at various angles in typewriter frames. The pallet "track" is about 100 feet in length, and occupies a floor space approximately 25 feet square. The machine has a total of 224 spindles and accommodates 26 pallets when fully loaded. Each pallet delivers two completed frames every thirty seconds. Eight double stations perform sixteen different operations. The pallets are loaded manually on a roller conveyor, which feeds them to a pick-up station. The pallets are then turned 90 degrees and fed into the first machining unit for drilling, reaming, and tapping. The pallet is then moved onto a turntable which rotates it 90 degrees for drilling and reaming on the second machining unit. Upon completion of this work, the pallet is moved to a roll-over station where it is positioned on its side and carried by the transfer bar to the third machining unit. After the drilling and tapping operations have been completed by this unit, the pallet, still on its side, is turned 90 degrees to permit drilling, reaming, and tapping the frame at the fourth unit.

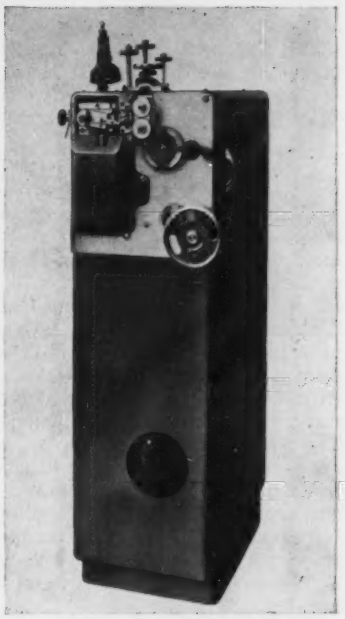
The pallet is then returned to its original position and transferred to the "wash" station, where it is submerged eighteen times in a solution for a complete cleaning before unloading. The machine is electrically powered, hydraulically operated, and adequately protected by safety features.

Circle item 114 on postcard, page 245

Torrington Spring-Coiling Machine

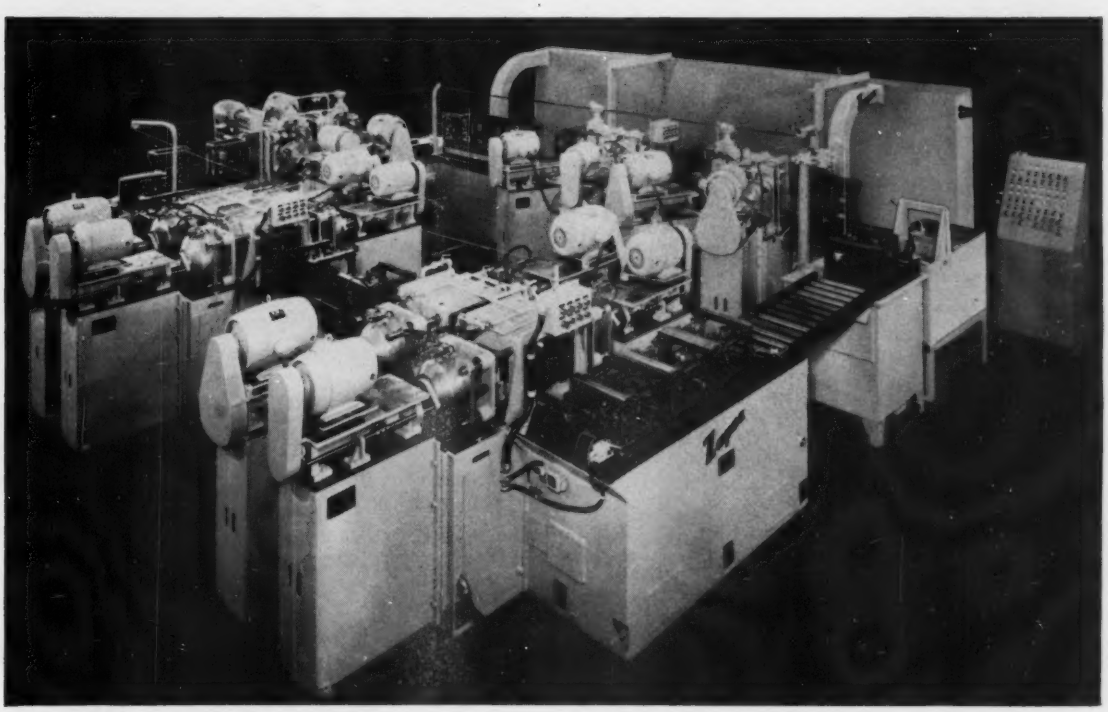
The Torrington Mfg. Co., Torrington, Conn., has introduced a W-10A Springmaker spring-coiling machine at the recent National Metal Show in Chicago. It is claimed that this machine will give increased production, greater accuracy and require less time for set-up than preceding models. Controls are more convenient, and provision is made for mounting additional mechanisms on the face of the front housing of the machine.

The machine will handle 0.008- to 0.028-inch wire ranging up to 24 inches in length, winding coils with outside diameters ranging from 1/16 to 7/8 inch. Extra wire feed gears permit the handling of



Springmaker spring-coiling machine designed for high production

up to 36-inch lengths of 0.008- to 0.024-inch wire and up to 48-inch lengths of 0.008 to 0.020-inch wire. Production ranges from 24 to 243 springs per minute with a motorized variable-speed transmission, and from 21 to 240 springs per



Pallet type transfer machine recently placed on the market by Zagar Tool, Inc.

minute with an electronic adjustable-speed drive.

The Springmaker measures 21 inches across the front at the base, is 28 inches deep, and weighs 695 pounds. Two drives can be used, either a 1/2-H.P. motorized variable-speed type or a 3/4-H.P. electronic adjustable-speed drive.

Circle Item 115 on postcard, page 245

Cincinnati "Tray-Top" Lathes

"Tray-Top" all-geared head lathes designed for manufacturing, maintenance, and tool-room use, have just been announced by the Cincinnati Lathe & Tool Co., Cincinnati, Ohio. These lathes have twelve spindle speeds in geometric progression, obtainable with a three-lever, "color-match," direct-reading shift mechanism. They are made in two sizes to swing work 21 1/2 and 26 inches in diameter, and will supplement the smaller "Tray-Top" machines introduced in 1947. The spindle, with its long-taper key-driven nose, is mounted in three precision anti-friction bearings. All headstock bearings are pressure-lubricated with filtered oil. Spindle speeds from 16 to 640 R.P.M. are available in the standard range, or from 24 to 960 R.P.M. in a high-speed range.

Thread and feed changes are made through a totally enclosed, automatically lubricated quick-change gear-box, where a lever to reverse the lead-screw is also incorporated. There are fifty-four thread and feed changes which give a range of 1 1/2 to 92 threads per inch and a feed range of from 0.0019 to 0.1215 inch.

The apron is a one-piece, double-walled casting with automatic lubrication. Longitudinal feeds and cross-feeds are engaged with drop levers that operate positive jaw clutches.

The bedways are ground, and will be flame-hardened on request. Lubrication of the carriage ways and cross-slide is provided by an oil shot plunger on the apron. An enclosed electrical panel provides a safe and accessible place for power connections. Power is transformed from 220 volts or over to 110 volts at the operator's push-button station.

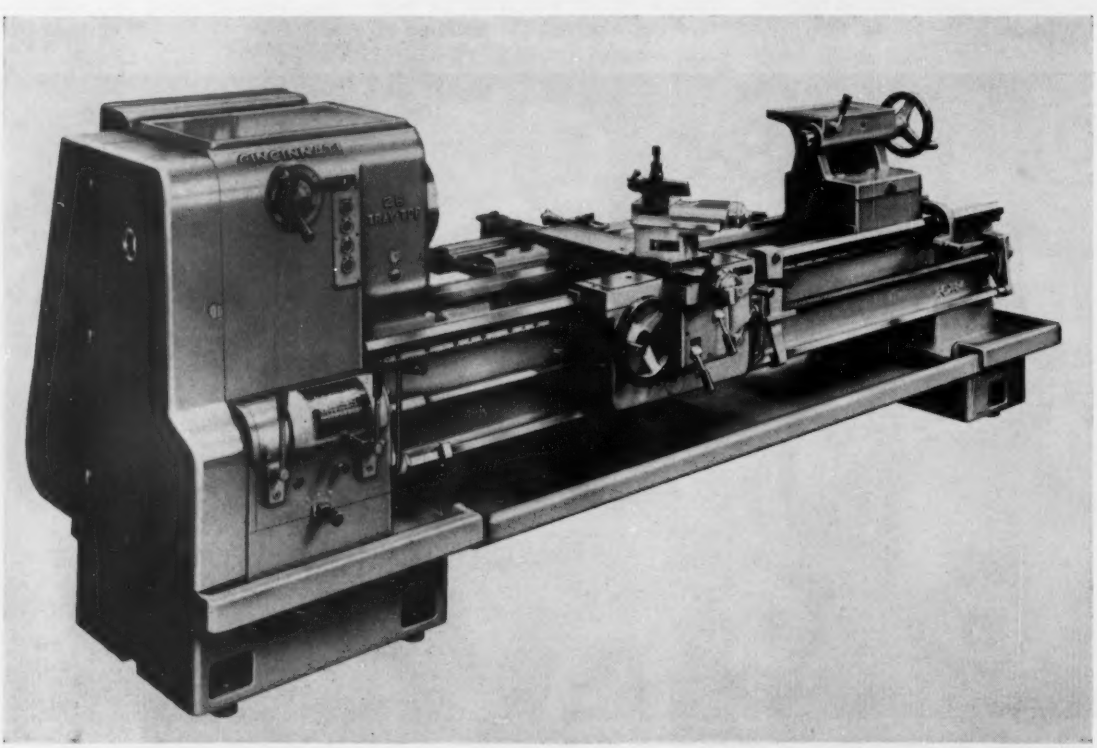
The lathes are offered with a 5- or 7 1/2-H.P. motor mounted on the rear of the headstock for easy maintenance. "Tray-Tops" on the headstock and tailstock provide safe places for laying down micrometers, tools, drawings and gages. Recessed, precision type, built-in leveling jacks complete the equipment.

Circle Item 116 on postcard, page 245

Gorton Multiple-Purpose Milling Machine

The George Gorton Machine Co., Racine, Wis., has added a horizontal-vertical universal milling machine to its standard line. Basically, this machine is a heavy-duty No. 2 or a medium-duty No. 3 horizontal mill with a "receptor ram" in place of the conventional over-arm. This receptor ram accommodates standard Gorton arbor supports and an arbor support brace, as seen in Fig. 1, for such operations as slab- or straddle-milling. For face-milling, the arbor supports and brace are removed, together with the arbor. Then, the receptor ram is moved to the rear until its front end is flush with the column face.

For super-speed vertical or angular milling, the receptor ram remains in the rear position and the



"Tray-Top" lathe with all-geared head added to line of smaller machines built by Cincinnati Lathe & Tool Co.

Fig. 1. Gorton horizontal mill with full-width knee, receptor ram, and universal head and ram assembly. Machine is shown set up for straddle-milling

universal head and ram assembly is moved forward to the cutting position, as shown in Fig. 2. In this way, three kinds of milling operations can be performed on the same machine.

The horizontal spindle has a speed range of from 25 to 2000 R.P.M. which adapts it to the use of carbide cutters and enables climb milling. By using a heavy-duty vertical attachment, roughing cuts can be taken within the same speed range. Then, for finishing, the vertical attachment can be swung aside and the super-speed universal head and ram assembly moved into position to provide speeds up to 5600 R.P.M.

The same type of machine is illustrated in Fig. 3 but with a super-speed plain vertical head and ram assembly. With this head, spindle speeds are available up to 4000 R.P.M. End-measuring rods and dial indicators can be installed for jig boring. A tracer head and duplicator table can be provided for manual duplicating.

Circle Item 117 on postcard, page 245

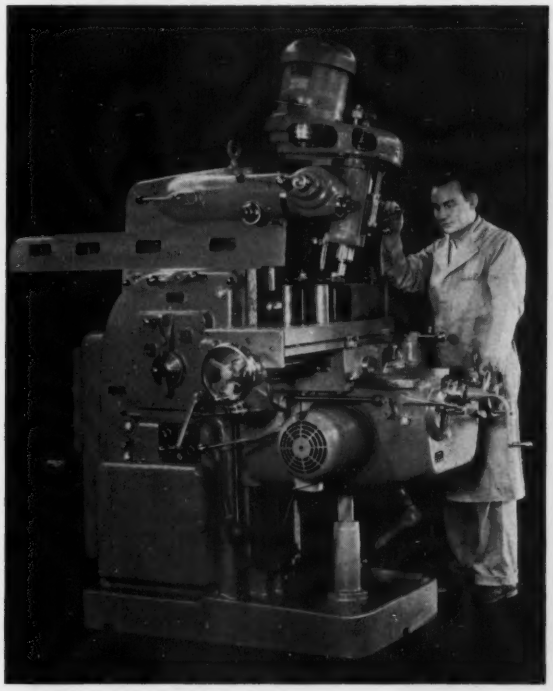


Fig. 2. Gorton horizontal milling machine arranged for angular super-speed milling operations

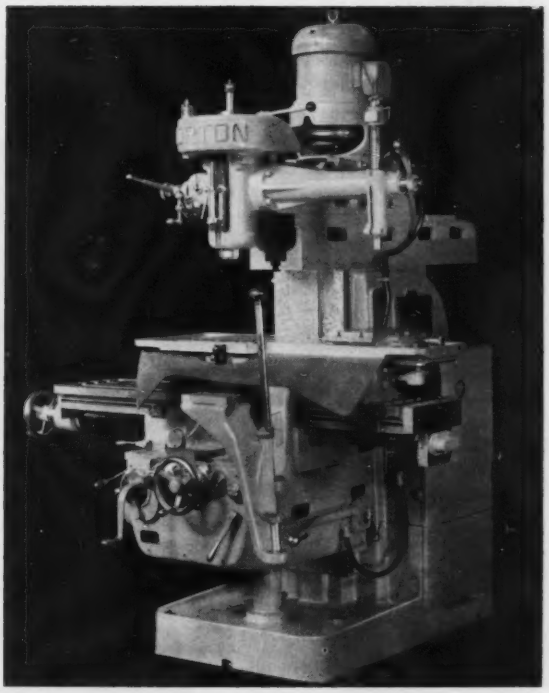


Fig. 3. Gorton horizontal mill, with vertical head and ram assembly, duplicator table, and tracer head

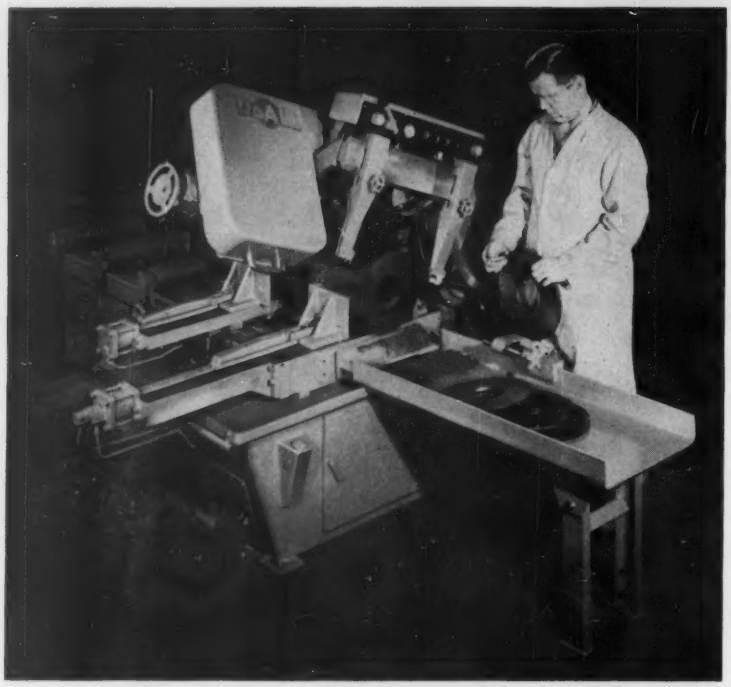


Fig. 1. Hydraulically controlled automatic power cut-off machine placed on the market by the DoAll Co.

DoAll Automatic Power Cut-Off Machine Designed to Use New Saw Band

The DoAll Co., Des Plaines, Ill., has brought out a power cut-off machine designed for its newly developed "Demon" high-speed steel saw band. Hydraulic controls and optional full automatic operation are outstanding features that make it possible for one man to tend a sizable battery of these new cut-off machines.

Levers and knobs for controlling every phase of the machine operation are centered on the panel mounted on the saw head, as shown in Fig. 1. The controls on this panel, shown also in the close-up view, Fig. 2, can be manipulated to obtain any desired operating condition. Movement of the saw head in either the up or down direction; adjustment of the sawing or feed pressure; the blade speed; rate of coolant flow; and changing from automatic to manual feed, or vice versa, are all controlled by simple manipulation of the levers and knobs on the panel.

The machine is made in four models. Model C-55 has manual stock indexing and Model C-56 has automatic indexing, both with single-speed transmission. Model C-57 is made for manual indexing, while Model C-58 is equipped for automatic stock indexing, these two having a variable-speed transmission. Standard automatic operation provides for the cutting of blanks up to 24 inches long. With minor modifications, automatic indexing can be used to cut longer blanks. Round bars up to 12 inches in diameter and flat bars 12 by 20 inches can be cut (12 by 12 inches when automatic indexing is employed).

Circle Item 118 on postcard, page 245

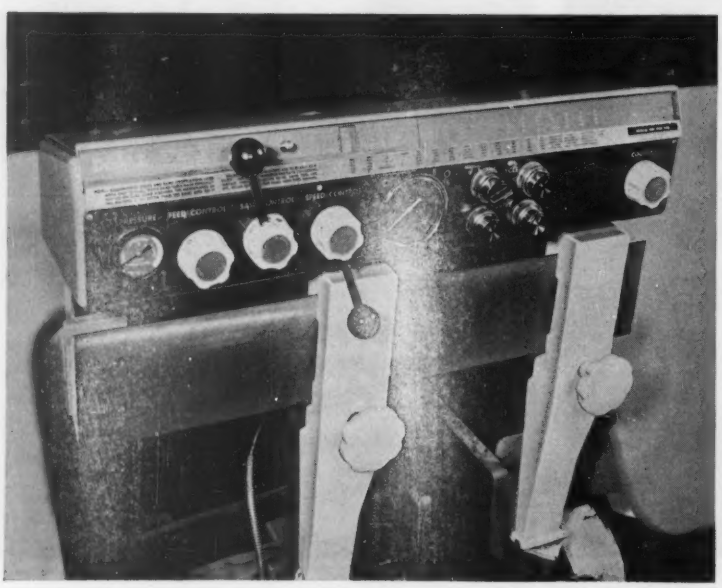


Fig. 2. Close-up of control panel of Do-All cut-off machine shown in Fig. 1

Sheffield Adjustable Airebore Gage Kit and Flatness Gages

The Sheffield Corporation, Dayton, Ohio, has announced an adjustable Airebore gage kit, any size hole between 3 to 12 inches in diameter being quickly and accurately inspected for size, taper, and out-of-roundness. The kit is seen in Fig. 1. All contact surfaces are of tungsten carbide. The Plunjet gaging cartridge, connected to a column type Precisionaire, provides 1000 to 1 amplification. The adjustable Airebore gage is light in weight, easy to use, and does not require master setting rings, as it is set to the diameter being gaged with gage-blocks and a 0 to 12-inch calibrator. The gage is self-centering and needs only to be rocked to ascertain the true diameter of the bore.

The Plunjet steel or stone flatness gages, now being manufactured by Sheffield, are designed for checking surface flatness and irregularities to a high degree of accuracy. The gaging element is a Plunjet gaging cartridge mounted in a steel or stone surface plate, as shown in Fig. 2, so that the

Fig, 1. Sheffield adjustable Airebore gage

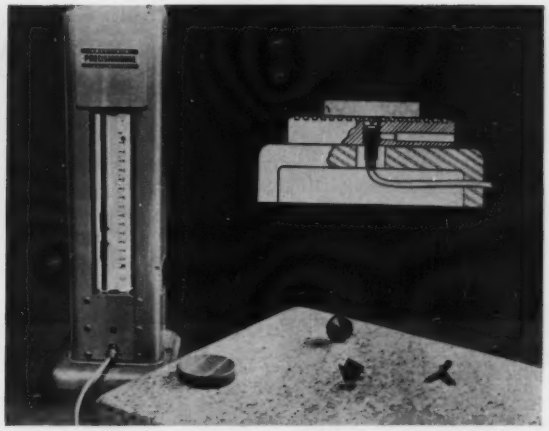


Fig. 2. One of Sheffield Plunjet flatness gages

contact point of the Plunjet projects slightly above the surface of the plate. The amplification of this gage is 2000 to 1.

Work-pieces to be gaged are placed on the surface plate and passed over the contact point of the Plunjet gaging cartridge. Any variation from a flat surface is indicated by the position of the float in the Precisionaire. No special skill is required to operate this gage.

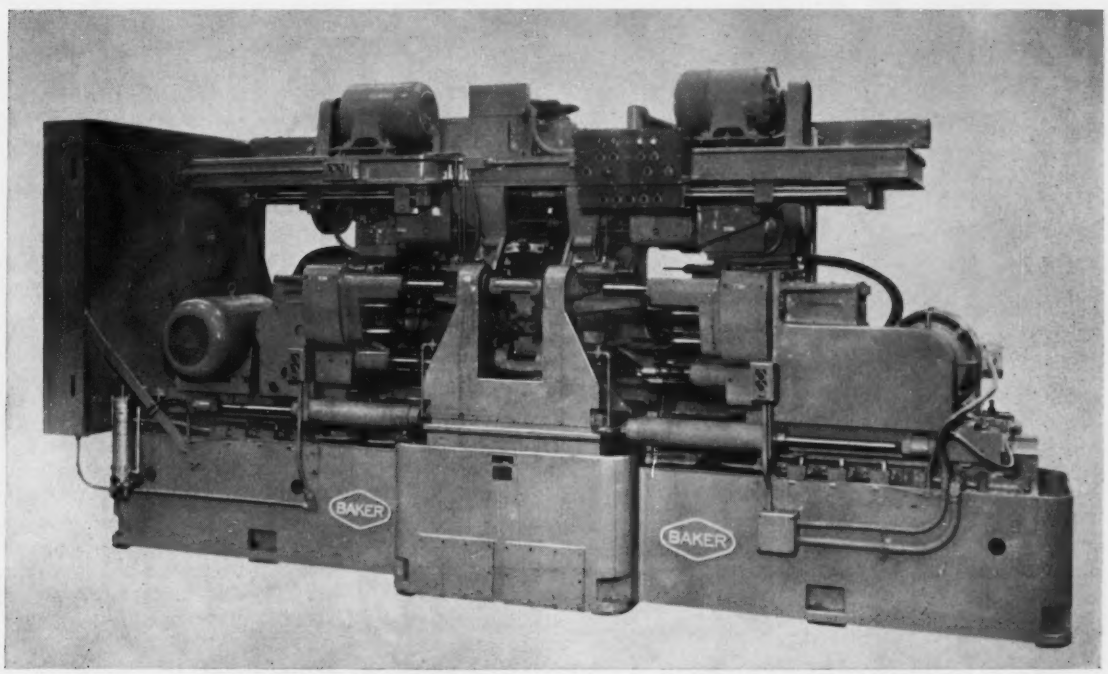
The steel flatness gage has a serrated surface plate 4 7/8 by 6 inches. Stone flatness gages are made of pink granite, 4 inches thick. These gages have an overall flatness that is accurate to 0.00005 inch. They are available in four sizes: 8 by 12 or 12 by 12 inches having two ledges, and 12 by 18 or 18 by 18 inches having four ledges.

Circle Item 119 on postcard, page 245

Baker Automatic Machine for Processing Automobile Parts

A machine equipped with a hydraulic feed designed to perform end operations automatically on integral parts for the ball joint suspension assemblies of an automobile has been brought out by Baker Brothers, Inc., Toledo, Ohio. This machine hollow-mills, drills, and taps holes in both ends of the part simultaneously, using high-speed tools. The production of this machine can be maintained at the rate of 250 parts per hour, two parts being loaded into the machine at a time.

Circle Item 120 on postcard, page 245



Machine for processing automobile part brought out by Baker Brothers, Inc.

Automatic Speeder for Sound-Testing Gears

Red Ring Model GSC gear speeders with automatic cycle controls are now available from the National Broach & Machine Co., Detroit, Mich. These machines have a capacity for sound-testing gears with a maximum outside diameter of 10 inches. They have air cylinder clamping and braking controls, and a push-button controlled automatically operated cycle in which the gear to be checked is run in contact with a mating production gear or a master gear.

These speeders are designed for mass production gear inspection operations on spur and helical gears, but cycle adjustments and fixture changes can be made to adapt them for the economical inspection of many gears made on a smaller production basis. The gear to be sound-tested is mounted in mesh with the master gear and clamped by actuating an air cylinder control. The automatic speeding cycle is then started by pressing the start-button.

In this cycle, the gear is run in one direction in mesh with the master gear. Then, a light brake load is applied by an air cylinder. Next, the brake load is removed and the gear is run in mesh in the opposite direction, after which a light brake load is applied. Following this sequence of operations, each of which takes place over a selected predetermined time, the machine stops. The operator can then unload the gear and, based on the sound during the test, either pass it on for the next operation, remove burrs and retest, or reject it. The model illustrated is designed for the sound testing of 1 5/8-inch diameter helical gears. It is powered by a 1-H.P. motor and measures about 64 inches high, 50 inches long, and 40 inches deep.

Circle Item 121 on postcard, page 245

Watson-Stillman Plastics Testing Machine

The Watson-Stillman Co., Division of H. K. Porter Co., Inc., Roselle, N. J., has announced a machine designed to test the flow characteristics of thermosetting plastics material by using the A.S.T.M. standard cup mold method. Dies can also be used in the machine to accommodate thermoplastics material.

The machine is hydraulically operated and is a completely self-contained unit, including standard heating plates, a motor-driven pump, a motor, a starter, and a control panel.

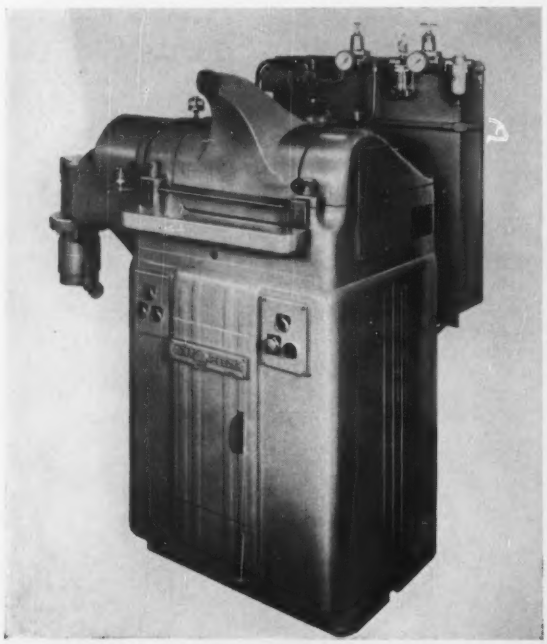
An Oilgear pump directly connected to a 3-H.P. flange-mounted motor provides an operating pressure of 2500 pounds per square inch. This gives the 6-inch stroke press a testing capacity of 15 tons. The platen is 12 by 12 inches and the daylight opening, 12 inches. The machine weighs approximately 1500 pounds, requires a floor space 16 by 40 inches, and has a height of 57 inches.

Circle Item 122 on postcard, page 245

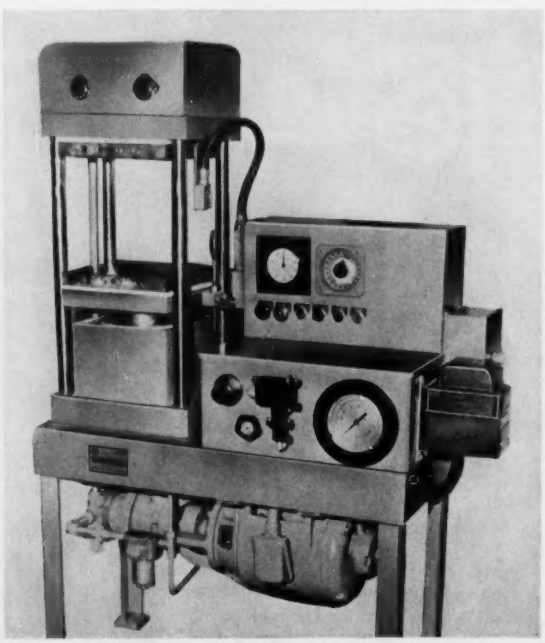
Press Brakes with Automatic Electric Control

The Dreis & Krump Mfg. Co., Chicago, Ill., has brought out an automatic electric control for its line of press brakes. The control unit consists of a foot-switch (which replaces the standard foot-lever); a solenoid for operating the clutch; an automatic switch box; and a control panel. Individual switches in the control panel permit setting the machine for performing a variety of movements in sequence to suit different kinds of work.

This automatic control is said to increase production on all types of press brake work, eliminate whipping and work spoilage due to kinking, reduce operator fatigue to a minimum, and provide greater

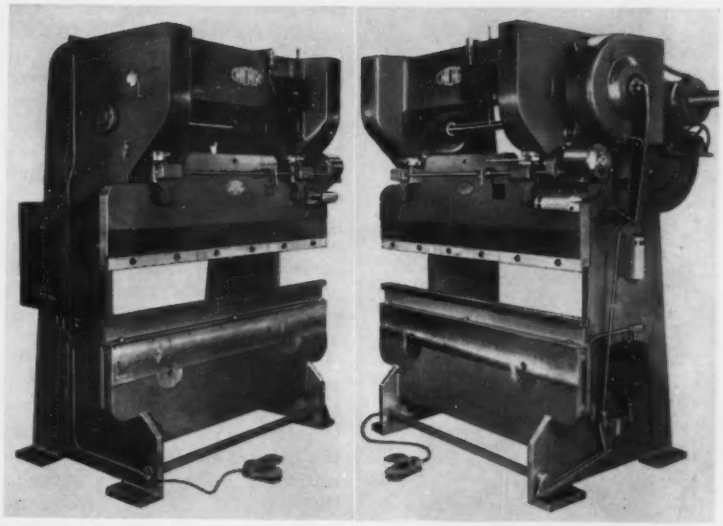


Red Ring automatic cycle speeder developed for sound-testing gears



Plastics testing machine placed on the market by the Watson-Stillman Co.

Dreis & Krump press brake equipped for automatic electric control. Control panel is seen in view at left, while clutch operating solenoid and switch box are shown at right.



safety. The press brake can be operated by either one or two men. Using two foot-switches, two men can work together.

Circle Item 123 on postcard, page 245

Landis Crankshaft Grinding Machine

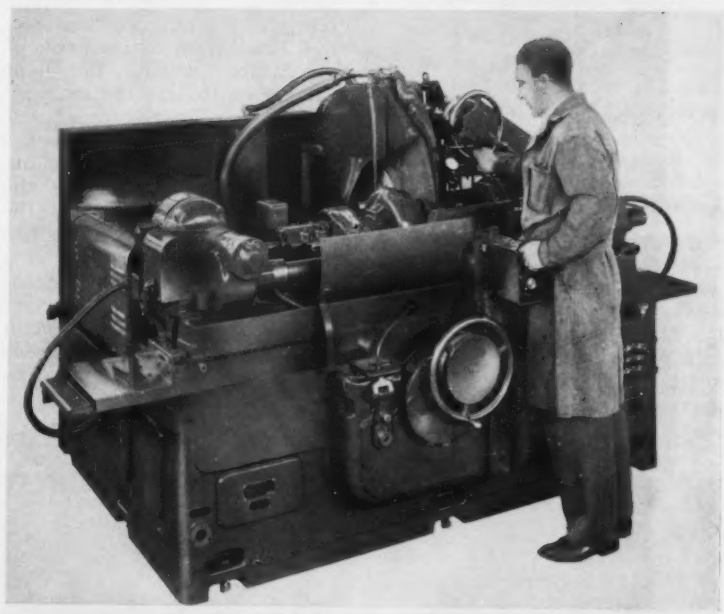
A precision grinding machine for finishing the pins of small crankshafts has been developed by the Landis Tool Co., Waynesboro, Pa., This machine is known as the 10-inch, Type H crankpin grinder and replaces a former model. It will grind crankshaft pins for outboard motors, lawn mowers, motorcycles, electric refrigerators, small auxiliary engines, and similar products. Certain small automobile crankshaft pins can also be ground.

The grinder is available in two lengths between centers for either 16- or 34-inch crank lengths. Crankshafts are held at both ends in heads which are driven in unison. The clamping fixtures are hydraulically operated. Both hand and hydraulic feeds are provided for the grinding-wheel head, which carries a wheel 36 inches in diameter. The wheel-head will advance rapidly and slow down for the grinding of cheeks and pin diameters. At a predetermined point, the feed will stop, and after a spark-out period, rapidly reset to the back position.

All controls are centrally located at the operator's normal working position. This includes hydraulic traverse with variable rate, which is dial-controlled. A two-speed hand traverse is provided.

Microsphere bearings are used for the grinding-wheel spindle. These one-piece steel bearings with babbitt linings can be adjusted for running clearance. Being spherical in shape, they align themselves to the spindle for maximum support.

Circle Item 124 on postcard, page 245



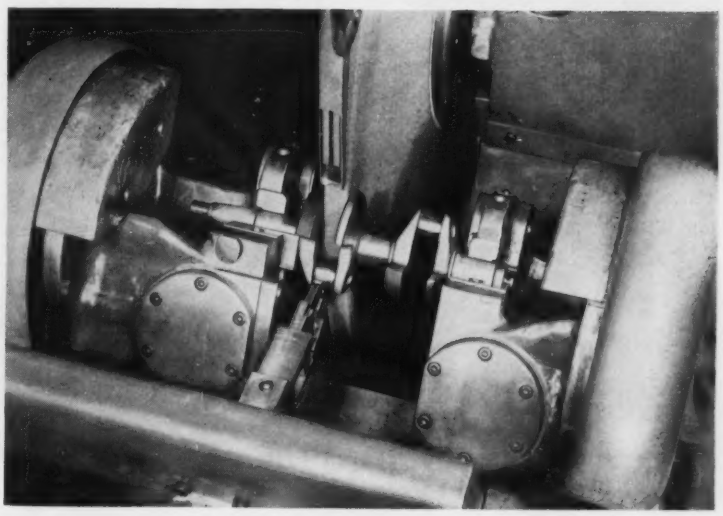


Fig. 1. (Center) Hydraulic crankpin grinding machine brought out by the Landis Tool Co.

Fig. 2. (Right) Close-up view of crankpin grinding operation performed on Landis machine

Pull-up broaching machine equipped for automatic handling of parts

Colonial Pull-Up Broaching Machine

A pull-up broaching machine with an automated set-up has been developed by the Colonial Broach Co., Detroit, Mich. It broaches the splines in two different models of a differential side gear at a production rate for both gears of 800 per hour. Gears are fed to four, side-by-side broaching stations by means of a continuous-chain loading conveyor carrying 144 individual work-holding fixtures, mounted four abreast. Conveyor travel begins at a convenient height for manual loading and continues upward at a steep angle until it reaches the broaching position, where the fixtures level off horizontally for the broaching operation. The broaching machine adapted to this operation is a standard Colonial RU 15-48 pull-up model.

The complete cycle of this machine consists of indexing four gears into the broaching position, broaching the splines, indexing the fixtures for broach return, and returning the four broaches through the gaps between the work-holding fixtures. A complete cycle requires only eighteen seconds. Small cams on the backs of the fixtures actuate the limit switches controlling the cycle sequence.

As the conveyor indexes the finished gears past the broaching station, it starts them on the downward path. At this point, the gears drop out of the fixtures through two chutes in each side of the machine. No clamping fixtures are required, stationary hold-down bars above the broaching station serving to keep each gear seated in its fixture during the broaching stroke.

Circle Item 125 on postcard, page 245

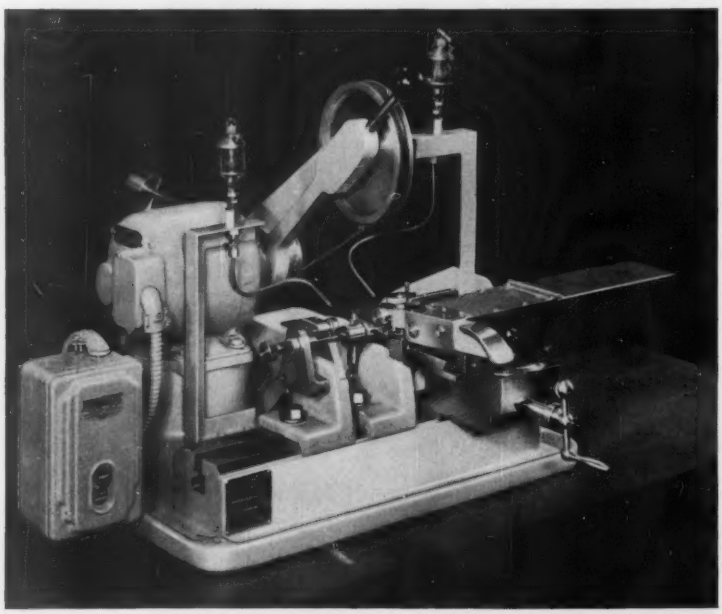
Rivett Armature Turning Lathe

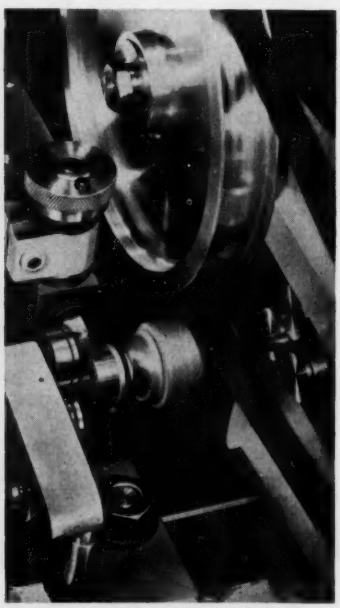
An armature turning lathe designed along new lines is being introduced by Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass. This Model 1AL machine is intended solely for turning armatures of small fractional horsepower motors. In operation, it turns the commutator while the armature revolves on its own axis. This is said to assure accuracy, fine finish, and high production.

The armature to be turned is mounted on two supports and is rotated on its own shaft by the friction drive of a revolving belt. The armature, revolving under the same conditions as when rotating on its own bearings, is turned concentric within close limits, tolerances on duplicate work being held to 0.0005 inch. Smooth finish is obtained by rotating the work at speeds up to 7000 R.P.M., which permits turning with diamond or carbide-tipped tools.

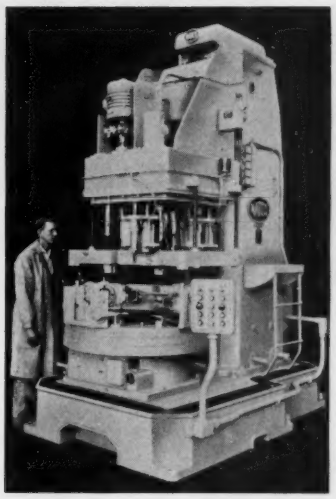
Production time per piece in turning commutators with a 3/8-inch long surface is eleven seconds. Two types of mountings are available for carrying the armature. On one, the shaft of the armature revolves on two carbide-inserted V-blocks. On the other, the shaft revolves on the periphery of two ball bearings.

Circle Item 126 on postcard, page 245





Armature turning lathe brought out by Rivett Lathe & Grinder, Inc.; and close-up view of work and belt drive



Combination machine for processing transmission rear-bearing retainers

Natco Heavy-Duty Drilling and Tapping Machine

The National Automatic Tool Co., Inc., Richmond, Ind., has announced a heavy-duty "Holesteel" combination drilling machine which is capable of drilling, reaming, spot-facing, and tapping twenty-seven transmission rear-bearing retainers per hour at an operating efficiency of 85 per cent. This machine is provided with a four-position fixture, mounted on an eight-position indexing table, and arranged to accommodate two parts in different locations in each position while performing the required machining operations.

Circle Item 127 on postcard, page 245

"Spra-Kool" Coolant System for Grinders

A "Spra-Kool" system designed to facilitate quick and economical application of spray-cooling to any type of dry grinding or polishing operation is announced by the Bar Products Co., Rockford, Ill. This system is also applicable to certain drilling, milling, chamfering, or boring work that does not require flood-cooling.

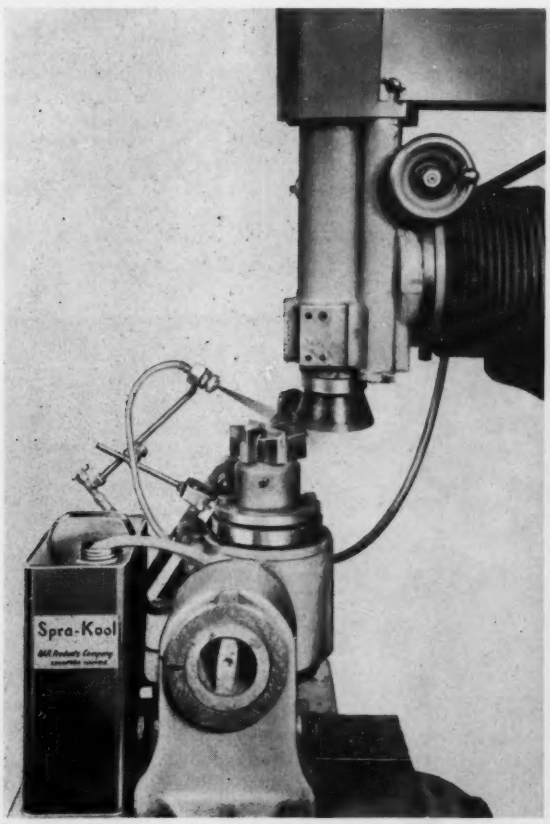
A spray nozzle provides a steady, uniform jet spray of coolant to tools and work. The fine spray prevents dust and efficiently dissipates heat from the work, allowing continuous grinding without burning, heating, or warping. Cooling action of the new "Spra-Kool" combines the advantages of rapid evaporation and forced air-jet penetration at the point of work-wheel contact.

By eliminating dry grinding, the system is said to provide longer wheel life, reducing the tendency of soft wheels to break down and hard wheels to load. In addition, it prevents damaging work from excessive heat and makes possible better finishes and increased output. A rust inhibitor mixed with the coolant also prevents tarnish and rust stains.

Circle Item 128 on postcard, page 245

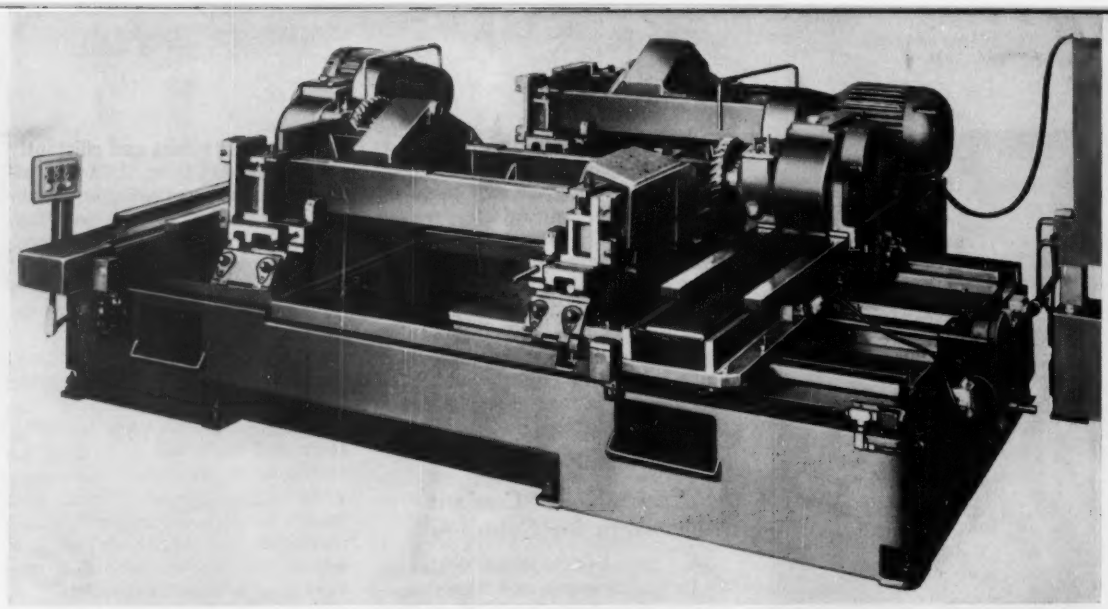
Presses with Double-Action Right-to-Left Drive

A series of one-point, double-action, right-to-left drive presses is being made by Danly Machine Specialties, Inc., Chicago, Ill., for one of the leading automotive manufacturers. These compact



Typical application of "Spra-Kool" system to grinder in tool manufacturing plant

Double-action press of compact design made by Danly Machine Specialties, Inc.



Machine built by Motch & Merryweather Machinery Co. for a new application of duplex milling

presses have a 26-inch stroke and 60-inch shut height on the inner slide, yet the over-all height of the press is only 21 feet.

Adjustments for the blank-holder have been kept inside the body of the press. Linkage bearing surfaces and blank-holder gibs are flushed with filtered oil from the Danly automatic lubrication system. The press is equipped with a clutch that provides for electrical acceleration of the slide motion for faster stroking without exceeding safe drawing speeds.

Circle Item 129 on postcard, page 245

Motch & Merryweather Duplex Milling Machine

A duplex milling machine, with heavy-duty, traveling milling heads instead of the conventional moving table and fixtures, has been built by the Motch & Merryweather Machinery Co., Cleveland, Ohio, for milling both ends of heavy tractor frames. The equipment includes two, floor-mounted, load-unload benches and duplicate sets of work-holding fixtures.

A traveling milling head is mounted on fixed ways at one end of the machine bed. Opposed to the fixed ways, and at the opposite end of the bed, is a saddle. The saddle can be adjusted on ways to accommodate work to be milled in lengths from 6 to 11 feet. Ways are provided on the saddle for mounting the second traveling milling head.

The tractor frame to be milled is located and securely clamped at each end in individual fixtures. The frame itself is sufficiently rigid to provide for joining the two fixtures into one solid unit. The clamping and locating of the frame in the fixtures are accomplished on a loading bench that is separate from the machine. The frame and fixtures are then placed on the machine, located by keys and secured by quick-acting clamps. Duplicate fixtures make possible the loading and unloading of one fixture while milling operations are performed simultaneously on work held in the other fixture of the machine.

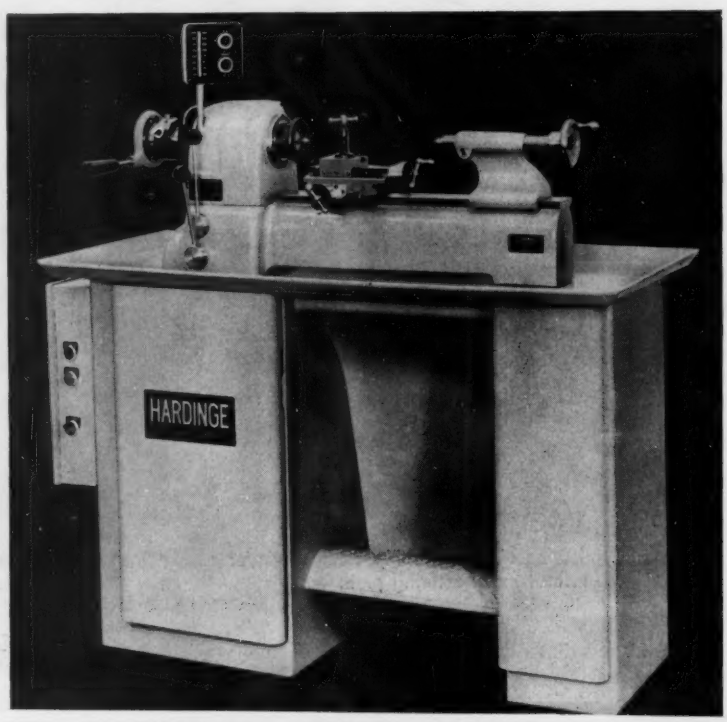
Features include non-metallic way liners, hardened and ground steel ways, and automatic pressure lubrication. Heads are hydraulically operated by dual pumps.

Circle Item 130 on postcard, page 245

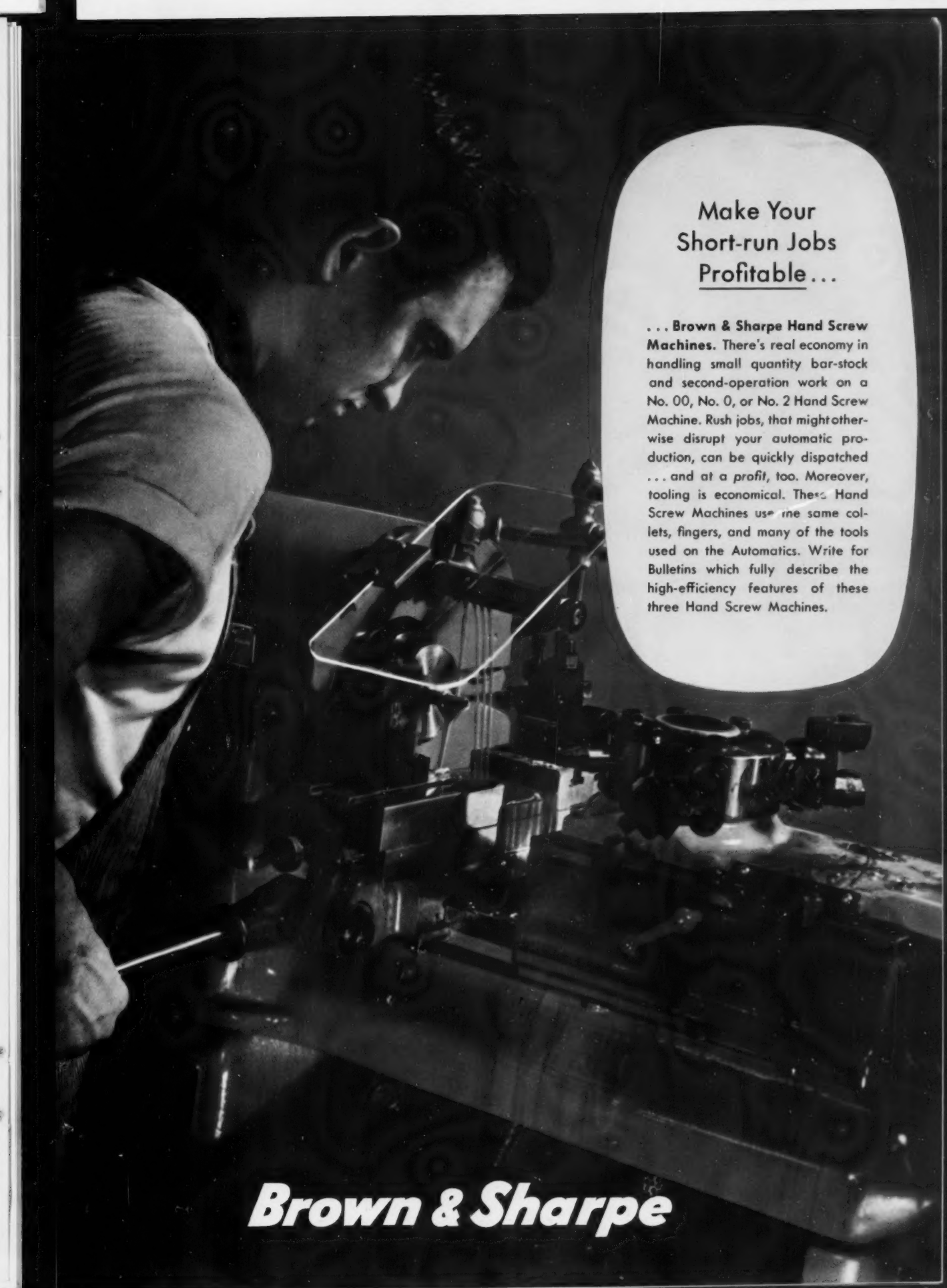
Hardinge Variable-Speed Lathe

Instantly variable spindle speeds are obtained by push-button control on the DV59 high-speed precision lathe, recently announced by Hardinge Brothers, Inc., Elmira, N. Y. This lathe is designed for use in tool- and instrument-making as well as production and gen-

(Continued on page 237)



Hardinge push-button controlled variable-speed lathe


Make Your
Short-run Jobs
Profitable...
. . . Brown & Sharpe Hand Screw Machines. There's real economy in handling small quantity bar-stock and second-operation work on a No. 00, No. 0, or No. 2 Hand Screw Machine. Rush jobs, that might otherwise disrupt your automatic production, can be quickly dispatched . . . and at a *profit*, too. Moreover, tooling is economical. These Hand Screw Machines use the same collets, fingers, and many of the tools used on the Automatics. Write for Bulletins which fully describe the high-efficiency features of these three Hand Screw Machines.
Brown & Sharpe

America's Only Micrometers
with Stainless Steel Spindle and Screw!
New Brown & Sharpe Micrometers give you complete protection from rust and stain—the common causes of excessive wear and loss of reading accuracy. Exclusive stainless steel, one-piece spindle and screw with hardened and ground threads is permanently rust-proof. Dull chrome frame and thimble resist acid perspiration and other causes of stain. Many other quality features, such as carbide measuring faces, give these new micrometers long lasting accuracy—make them easier to use. Write for Catalog 35M and read all about the hundreds of precision hand tools made by Brown & Sharpe.
BUY THROUGH YOUR LOCAL DISTRIBUTOR
Brown & Sharpe
BROWN & SHARPE MFG. CO., PROVIDENCE 1, R. I., U.S.A.
Milling Machines • Grinding Machines • Screw Machines • Cutters • Machine Tool Accessories
Machinists' Tools • Electronic Measuring Equipment • Johansson Gage Blocks
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Printed in U.S.A.

eral machine shop work. It is power-operated from a control box located over the headstock. Changes in spindle speed are accomplished by pressing either the "faster" button or the "slower" button until the desired speed is reached. An easily read speed indicator with a range of from 230 to 3500 R.P.M. shows the exact speed at all times.

Standard equipment includes a ball-bearing, lever-operated collet closer which gives fast and positive collet gripping. The collet or step chuck can be opened or closed while the machine is running or stopped, thus saving production time. Collet tension is instantly adjustable throughout the full range of light to heavy holding power without the use of tools. The lathe is fitted with the new 5C Hardinge collet and holds work up to 11/16 inches in diameter.

Circle Item 131 on postcard, page 245

LeBlond Heavy-Duty Engine Lathe

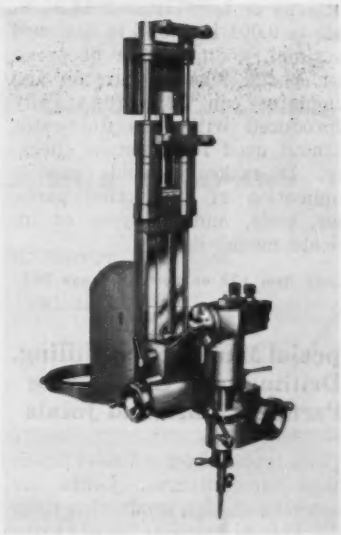
The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, has announced the development of a 32-inch heavy-duty engine lathe equipped with a 125-H.P. two-speed, direct-current motor. Infinitely variable speeds ranging from 42 to 1400 R.P.M. are available. There are fifty-six feeds, ranging from 0.002 to 0.250 inch per revolution. Features include a four-directional power rapid traverse mechanism built into the apron; a one-piece apron and hardened rack; a totally-enclosed quick-change gear-box; hardened and ground steel bedways; and a thrust-lock tailstock.

A power consumption of 118-H.P. at the cut was registered in making a test run with this machine on a piece of S A E 1045 steel 12 1/2 inches in diameter by 48 inches long, having a Brinell hardness of over 200. The cut was made at a speed of 205 surface feet per minute and a feed of 0.083 inch per revolution at a cutting depth of 1 inch. The meter showed a reading of 2 H.P. before starting the cut and a reading of 120 H.P. during the cut. This lathe is designed for use wherever high-power metal-turning is advantageous, including the building of marine, railway, and hydro-electric equipment, Diesel engines, and steel mill rolls.

Circle Item 132 on postcard, page 245

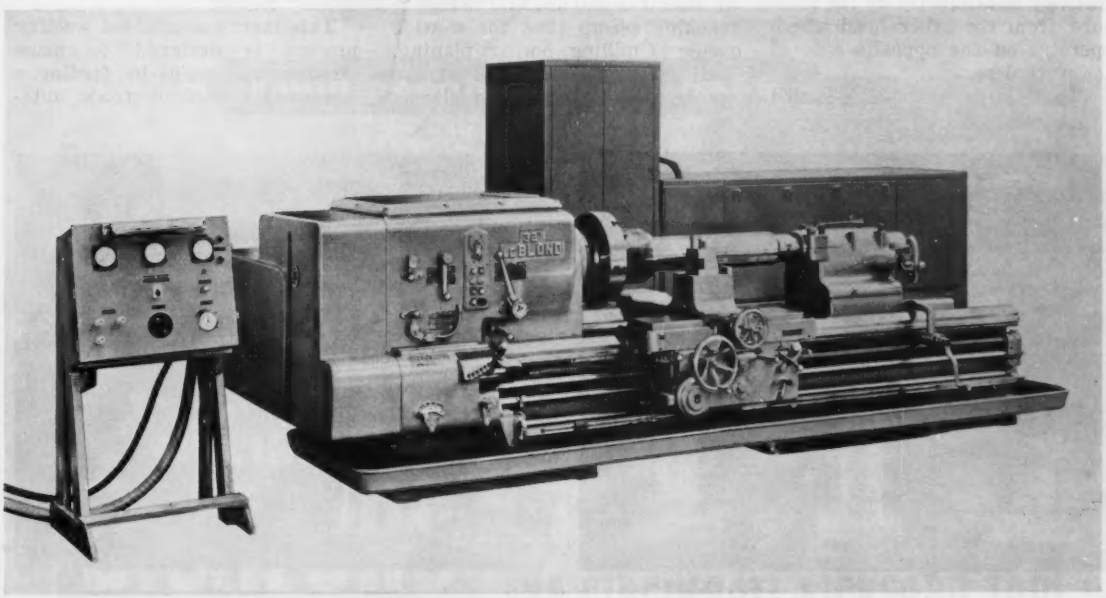
Goodrich Hydraulic Duplicator

The Goodrich hydraulic duplicator designed for attachment to any new or old model miller, lathe, shaper, or grinder is now being manufactured by Automotive Service Tools, Inc., Division of Lansing Die Sinking Co., Lansing, Mich. This duplicator is said to reduce labor costs and increase production efficiency on all kinds of contour and die-making jobs. It is adaptable for use in small tool shops as well as large manufacturing plants.



Goodrich hydraulic duplicator attachment

The unit is powered by a motor which is attached to the side of the machine and delivers hydraulic pressure for automatic duplication of the most intricate master



Heavy-duty production lathe brought out by the R. K. LeBlond Machine Tool Co.

patterns or templates. It is accurate to 0.001 inch and is designed to simplify duplication of precision parts. Master patterns and templates can be automatically reproduced with this duplicator without need for constant checking. It makes possible precise duplication of production parts, dies, tools, and all types of intricate machining.

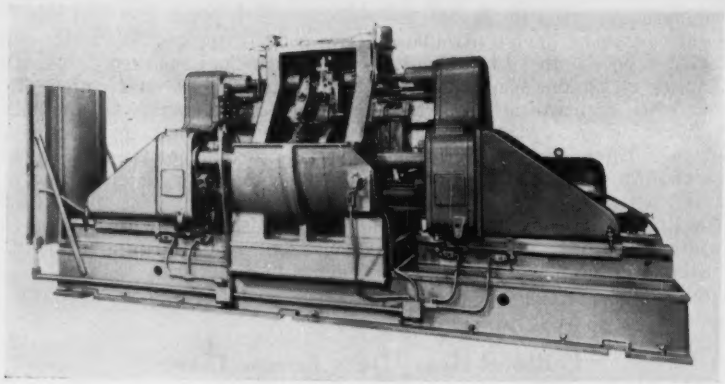
Circle Item 133 on postcard, page 245

Special Machine for Milling, Drilling, and Chamfering Parts for Universal Joints

Two types of forged steel flange yokes for universal joints are processed at high production rates on a special machine built by the Morris Machine Tool Co., Cincinnati, Ohio. The dual-part feature of this special-purpose machine is made possible by providing interchangeable fixtures that properly position each part for machining. The fixtures are equipped for hydraulic clamping and unclamping to obtain the work-holding capacity required.

The flange yokes to be processed have two bosses which must be drilled to a finished diameter of 1.535 to 1.530 inch. An automatically indexed trunnion carries the parts between two opposed horizontal heads. The set-up is such that the drilling pressure of one head on one side of the part is effectively counteracted by the pressure from the other head which operates on the opposite side of the workpiece.

The fixtures are double-loaded to obtain a production rate of 158 pieces per hour; this involves feeding two 1-inch drills and two 1 7/16-inch core-drills simultaneously. In addition to drilling and chamfering, the machine rough- and finish-mills two surfaces 3 1/2 inches in diameter.



Special machine manufactured by the Morris Machine Tool Co. for processing universal joint parts

Circle Item 134 on postcard, page 245

Ingersoll Clamp Posts for Machine Set-Ups

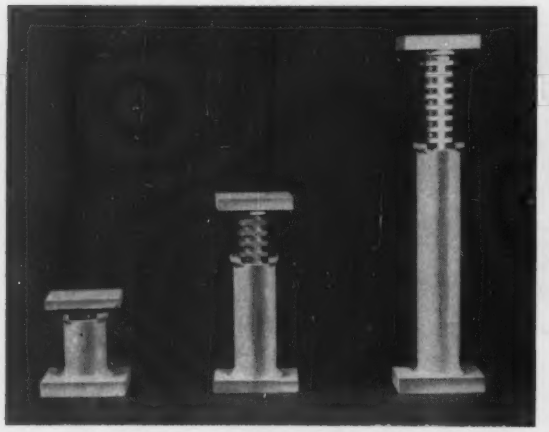
Clamp posts developed by the Ingersoll Milling Machine Co., Rockford, Ill., to help support work-pieces during machining operations are available in 4-, 7-, and 12-inch sizes which are adjustable to heights of 7, 12, and 22 inches, respectively. These posts are suitable for use on most kinds of machines and are said to reduce machine set-up time for a wide range of milling, boring, planing, and drilling operations. They are employed with hold-down clamps to keep work rigidly in position by replacing makeshift set-up equipment such as metal or wood blocks. The posts are adjustable in 1/2-inch increments and are raised by lifting and turning the stem.

Circle Item 135 on postcard, page 245

Linde Sigma Spot-Welder

A manual sigma spot-welding process, which makes spot-, plug-, and tack-welds by the addition of reinforcing filler metal, was introduced at the National Metal Show, in Chicago, by the Linde Air Products Co., a Division of Union Carbide and Carbon Corporation, New York City. The process is said to overcome limitations of existing spot-welding methods by heavier metals.

This inert gas-shielded welding process is designed to make stronger spot-welds by feeding a consumable wire electrode auto-



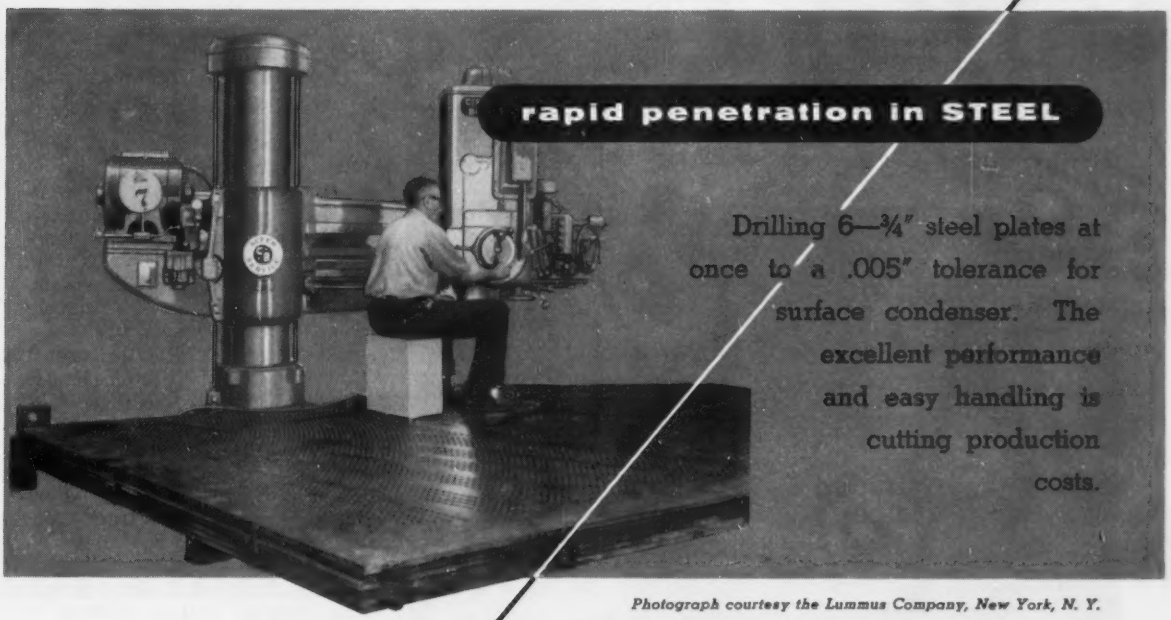
Adjustable clamp posts developed by the Ingersoll Milling Machine Co.

Sigma spot-welding torch brought out by the Linde Air Products Co.

rapid drilling with ACCURACY saves money

at THE LUMMUS COMPANY

On jobs like these the ease of control, the accuracy and the outstanding speed of penetration of Cincinnati Bickford Radial Drills pay big dividends.



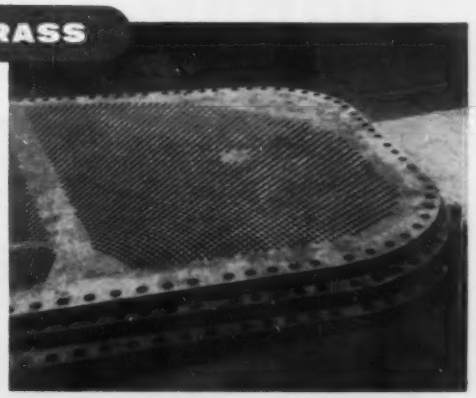
rapid penetration in STEEL

Drilling 6—¾″ steel plates at once to a .005″ tolerance for surface condenser. The excellent performance and easy handling is cutting production costs.

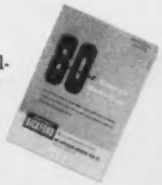
Photograph courtesy the Lummus Company, New York, N. Y.

rapid penetration in BRASS

Drilling 4 brass tube sheets, 1½″ thick, simultaneously to a .002″ tolerance, a special spiral brass drill penetrates at the rate of 10″ per minute.



Of interest to every user of Drilling Machines—Write for your copy of 80-year Anniversary Booklet.



CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

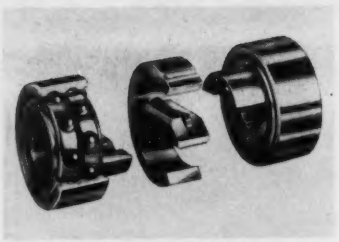
matically into the weld area. The filler metal makes a 100 per cent penetration in the lapping metals. Spot-welds can be made quickly and easily on metals up to 1/8 inch in thickness, in a horizontal or vertical position. The operator simply places the nozzle of the sigma spot-welding torch on the work, as shown in the illustration, and squeezes the trigger. Current, water, and argon flows start and shut off automatically.

The process can be used on carbon and galvanized steel, stainless steel, copper-based alloys, and other metals. It can also be used to make plug welds on metals from 1/8 to 1/4 inch thick and tack welds on all types of joints for subsequent welding. An operator can make up to ten welds a minute, including positioning and post-weld argon flow.

Circle Item 136 on postcard, page 245

Ahlberg "Nobak" Torque Transmitting Device

A device for transmitting torque while positively preventing reverse torque action is being manufactured by the Ahlberg Bearing Co., Chicago, Ill. This device, called "Nobak," transmits torque in both clockwise and counter-clockwise rotation and can be used to lock a driven mechanism in any angular position. This device can be used in all types of vehicles; in hoists, cranes, and conveyors; in actuator mechanisms; and in all other equipment requiring positive angular positioning and protection against reverse torque. For example, when it is used in the steering mechanism of a vehicle, the operator can steer in the conventional manner, but any forces exerted by the front wheels cannot apply a kick-back action to the steering wheel.



"Nobak" torque transmitting device announced by Ahlberg Bearing Co.

Circle Item 137 on postcard, page 245

Fig. 1. Equipment for simulated-service fatigue testing of gears and gear lubricants built by the Sonntag Scientific Corporation, a division of the Baldwin-Lima-Hamilton Corporation

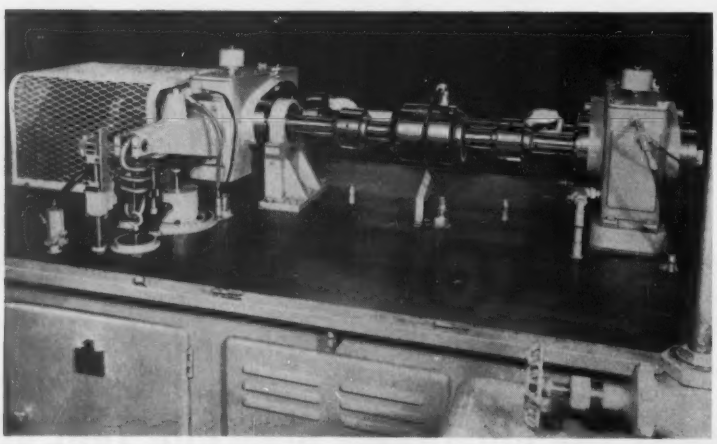


Fig. 2. Close-up view of table of Baldwin-Sonntag fatigue testing machine

Equipment for Testing Gears and Lubricants

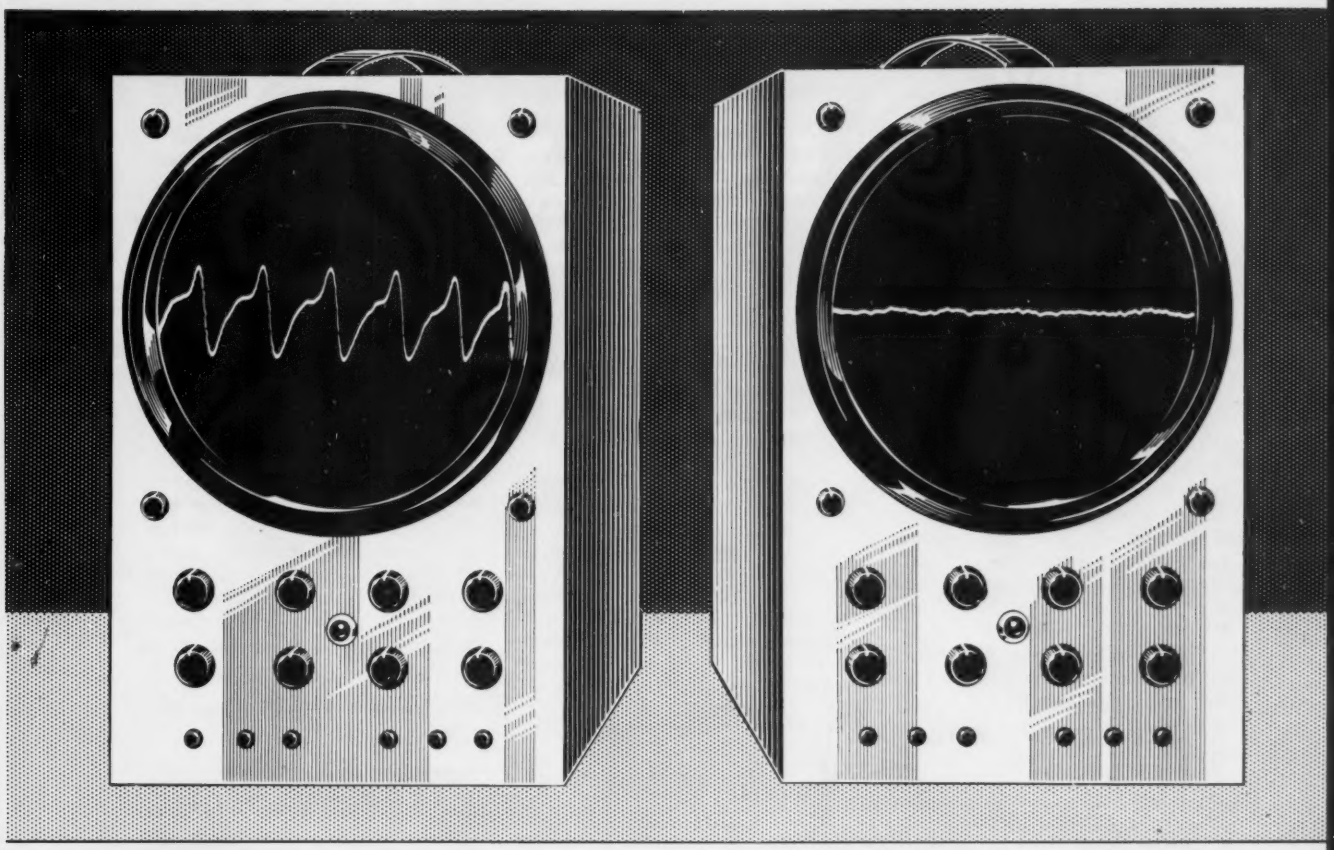
Simulated-service fatigue tests of gears running under loads and speeds encountered in normal operation can be made by special equipment developed and built by the Sonntag Scientific Corporation, a division of the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. Development was in cooperation with the International Harvester Co. The equipment also provides means for testing lubricants at temperatures between 70 and 350 degrees F.

The control cabinet shown at the left, Fig. 1, includes the torque indicator for the SR-4 torque pick-up; a lever force gage; an oil temperature controller; and various other indicators and controls. The fatigue testing machine is shown at the right of the cabinet.

The test gear and pinion are placed in the gear-box at the right end of the testing table of this machine, seen in the close-up view, Fig. 2. The drive gear-box shown at the left end of the table is pivoted on the drive-shaft or pinion shaft so that the downward force, applied by means of the lever, tends to raise the load gear and rotate it on the load pinion. Universal joints in the shaft eliminate restrictions imposed by the rigidly fixed test gear-box. Torque is measured by the Baldwin SR-4 torque pick-up at the center of the pinion shaft.

With the testing equipment shown, gears can be subjected to torques up to 30,000 inch-pounds with a maximum tooth load of 14,400 pounds. Pinion speeds can be varied between 750 and 2500 R.P.M. to transmit up to 1200 H.P.

Circle Item 138 on postcard, page 245



WHEN A STRAIGHT MINERAL OIL was used to lubricate the ways, an 0.0008″ jump at frequency of 2.74 cycles per second was noted.

WHEN SUNOCO WAY LUBRICANT was used on the ways, the jump was too small to measure, proof that this medium stops slip-stick motion.

TEST PROVES SUNOCO WAY LUBRICANT ENDS SLIP-STICK TABLE MOTION

How effectively Sunoco Way Lubricant stops slip-stick table motion is graphically illustrated by these oscillograms. The pattern on the left was made with a straight mineral oil as the lubricant; the other was made with Sunoco Way Lubricant on the ways. Both patterns are magnifications of changes in rate of table travel and were obtained under identical conditions.

You can stop slip-stick table motion, protect the ways, get better surface finishes, cut production losses with Sunoco Way Lubricant. Try it in your shop. For more information, call your nearest Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. M-12.

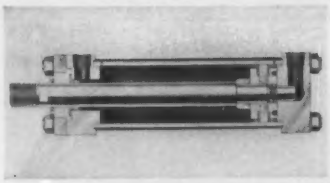
INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

SUNOCO®

PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL

Refiners of the famous Blue Sunoco Gasoline and Dynalube Motor Oils



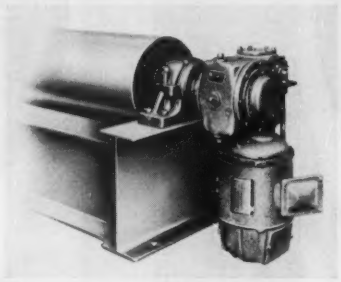
Vickers Hydraulic Cylinder

Hydraulic cylinder of a new line announced by Vickers Incorporated, Detroit, Mich., for applications in the machine tool and metal-working fields. The "Compact" cylinders of this line are manufactured by the Waterbury Tool Division of Vickers. They are designed to occupy a minimum amount of space, and comply with J.I.C. standards. The cylinders are conservatively rated for a maximum working pressure of 2000 pounds per square inch. Adjustable hydraulic cushions can be furnished on either or both ends of the cylinders to decelerate piston rod movement.

Circle Item 139 on postcard, page 245

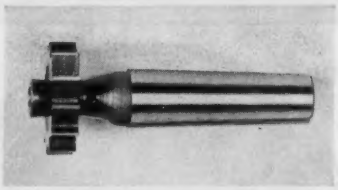
Floating "GearMotoR" for Driving Rolls or Conveyors

Floating "GearMotoR" developed by the Philadelphia Gear Works, Philadelphia, Pa., to provide a roll or conveyor drive that is entirely self-contained and permits the entire unit to be located close to



the driven machine. The unit provides a range of output speeds from 8 to 800 R.P.M. with integral electric motors of 1 to 15 H.P.

Circle Item 141 on postcard, page 245



Keyseat Cutter

New style Woodruff keyseat cutter manufactured by the Quality Tool Works, Waukegan, Ill. This line features a tapered shank of high-speed steel, and a special surface treatment after the cutter is finish-ground. The cutter shank is securely locked in a holder which will fit any standard milling machine, providing an unusually rigid and true-running set-up which assures accuracy and long cutter life. The cutters are available from stock in forty-one standard sizes, and special sizes can be made to order.

Circle Item 143 on postcard, page 245

G-E Rectifier Type Welder

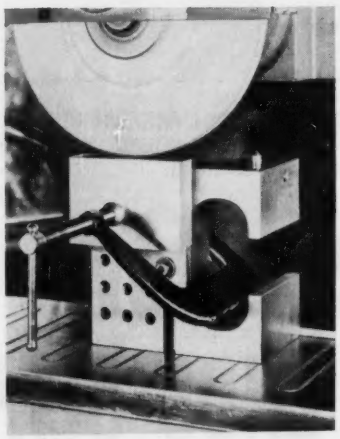
Rectifier type welder featuring quiet operation and low maintenance cost, marketed by the General Electric Co., Schenectady, N. Y. This welder has an NEMA rating of 300 amperes and is designed to offer full time arc-force control for holding very short arcs with deep penetration in a current range of 20 to 375 amperes. The welder utilizes the moving primary coil design, obtaining stepless current adjustments by separation of primary and secondary coils. A fully automatic arc-force control gives an extra surge of current to blast away short-circuiting metal drops.

Circle Item 140 on postcard, page 245

Wheelco Electronic Controller

New "400" series "Capacitrol" electronic controller being marketed by the Wheelco Instruments Division, Barber-Colman Co., Rockford, Ill. Available in many control forms, this self-contained, direct-deflection type, indicating controller is adaptable to a multitude of process applications, a few of which include heat-treating furnaces, ovens, glass and ceramic kilns, and machinery for extruding and molding plastics and non-ferrous metals. The "400" series controller can also be used for such applications as indicating and controlling voltages, current, speed, and similar variables in process industries.

Circle Item 142 on postcard, page 245



"Federal Square Master" Angle-Plate

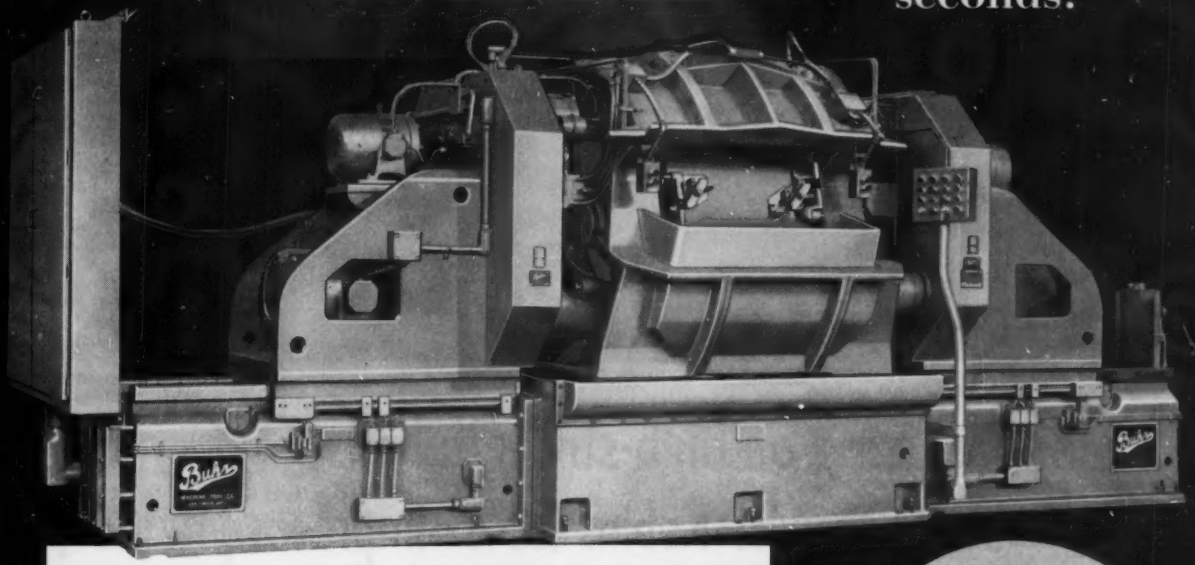
The Federal Machine Tool Co., Bristol, Conn., has just announced a "Federal Square Master" angle-plate for use in grinding a work-piece square. With this tool, an apprentice can grind a work-piece so that it will be square within extremely close limits without the use of such auxiliary tools as an indicator, a precision square, or a surface plate. The angle-plate can be used to the same advantage on lay-out and inspection work, since all working surfaces are guaranteed to be square within 0.0002 inch.

Circle Item 144 on postcard, page 245

Buhr

SPECIAL...

Drills, chamfers and taps two rear axle drive shafts every 22 seconds!



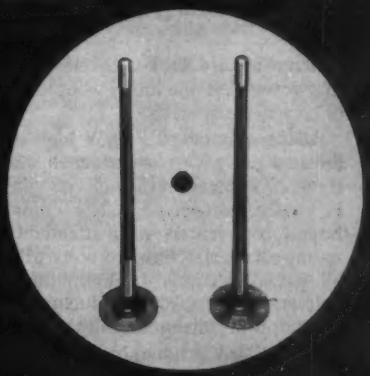
This Trunnion-Type Buhr Special drills, chamfers (both sides of holes) and taps 328 pieces an hour at 100% efficiency.

Two parts are loaded per fixture on this 6-station, 2-way Buhr Special.

Hydraulic clamping-and-unclamping is completely automatic.

Cluster heads — incorporated in a master gear box — are featured, as with all Buhr Trunnion-Type Machines.

On Buhr Specials, all parts are held to tolerances and are completely interchangeable. All component assemblies are located by precision-bored dowels. These Standard Buhr Features assure precision alignment!



See the complete range of Buhr Specials.
Send for catalog
or let one of our sales executives call on you.

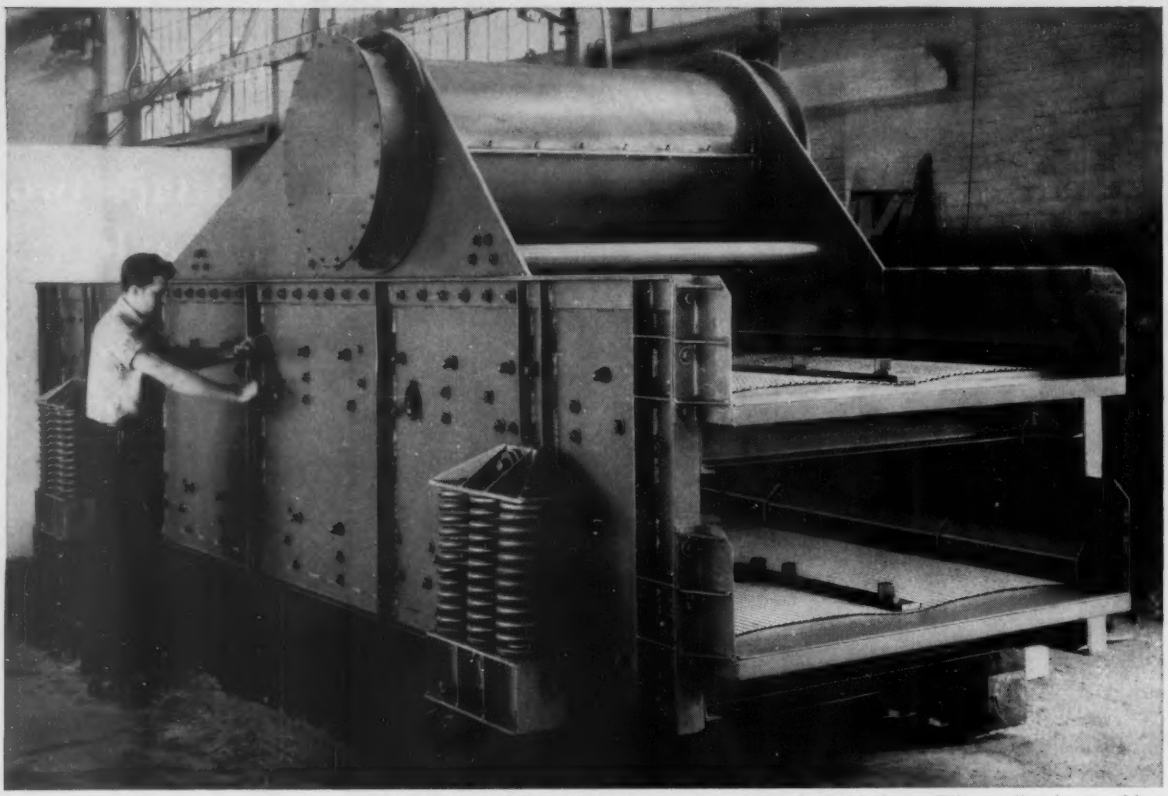
BUHR MACHINE TOOL CO.

252 GREEN STREET, ANN ARBOR, MICHIGAN

Solidly Engineered . . . Precision Built for World's Leading Manufacturers

Buhr

MULTIPLE-SPINDLE HIGH PRODUCTION MACHINERY



ASSEMBLING an RB&W high-strength bolt on Hewitt-Robins' new Eliptex vibrating machine.

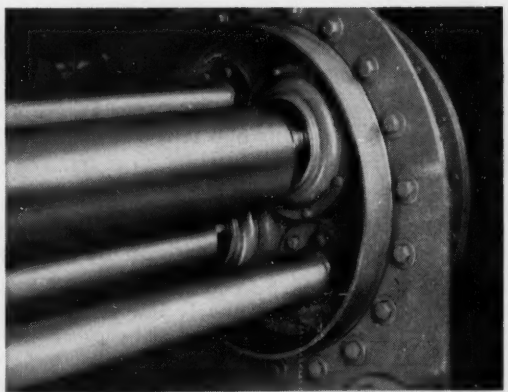
Standardizing on high-strength bolts saves Hewitt-Robins 25%—improves product!

Take a hard look at your fastening operations and you may find you will save a lot by using standard high-strength bolts instead of expensive specials.

Using a standard RB&W high-strength bolt plus a heavy semi-finished nut with two hardened washers, Hewitt-Robins is getting these advantages and savings on vibrating machines: 1. Saving 25% in yearly fastener cost. 2. Eliminating situations requiring body-bound connections with attendant reaming operations. 3. Eliminating all special, finished bolts with varied thread lengths and also all special lock nuts. 4. Eliminating procurement problems and slow delivery of specials. 5. Reducing nut and bolt inventory. 6. Obtaining better performance and lower maintenance on units.

The RB&W product has 2½ to 3 times the clamping force of the previous fasteners. Thus the assembled connection is better able to withstand severe vibration.

Maybe your operation doesn't give fasteners as hard a time as vibrating equipment, but it pays to look into the savings you can expect from specifying standards instead of specials. RB&W has the answers to your questions.



DETAIL VIEW of Hewitt-Robins vibrator, showing RB&W high-strength bolts which must resist shear stress as well as vibration. 4.8

See our insert on high-strength bolts in Sweet's Architectural and Industrial Construction Files.

RB&W **RUSSELL, BURDSALL & WARD**

109 YEARS MAKING STRONG THE THINGS THAT MAKE AMERICA STRONG

Plants at: PORT CHESTER, N.Y.; CORAOPOLIS, PA.; ROCK FALLS, ILL.; LOS ANGELES, CALIF. *Additional sales offices at:* ARDMORE (PHILA.), PA.; PITTSBURGH; DETROIT; CHICAGO; DALLAS; SAN FRANCISCO. *Sales agents at:* NEW ORLEANS, DENVER, SEATTLE. *Distributors from coast to coast.*

For more information on products advertised, use Inquiry Card, page 245

PRODUCT INFORMATION SERVICE

Use postage-free Business Reply Cards for further information
On New Catalogues described in this issue of MACHINERY
On products mentioned in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

ALUMINUM ROD, BAR, AND WIRE—Technical Editor, Kaiser Aluminum & Chemical Sales, Inc., 22 N. LaSalle St., Chicago 1, Ill. 160-page book entitled "Kaiser Aluminum Rod, Bar, and Wire Product Information," designed to assist engineers, designers, production personnel, and purchasing executives in the selection and specific use of the most suitable aluminum rod, bar, and wire for different applications. Contents deal with the production of aluminum and its specific properties and characteristics as related to rod, bar, and wire, as well as new data regarding various alloys, their characteristics, fabrication, and finishing methods. In referring to aluminum alloys, the four-digit index system is used. This book may be obtained free of charge when requested on a company letterhead direct to the above address, or at a cost of $2 for personal libraries.

CENTRIFUGAL CASTINGS — Lebanon Steel Foundry, 110 Lehman St., Lebanon, Pa. 12-page brochure treating the entire process of design, manufacture, and final application of Lebanon centrifugal castings. Two processes are described—one in which the casting is formed on vertical axis machines, using permanent molds; and the other describing the process in which horizontal axis machines are used with special refractory molds. Present and possible future design applications are discussed. This booklet can be obtained by writing on a company letterhead to Mr. William H. Worrilow, Jr., General Sales Manager, at the above address.

ABRASIVE CUTTING PROBLEMS—Wallace Tube Co., 1304 Diversey Parkway, Chicago 14, Ill. 40-page booklet entitled "Why Do Abrasive Cut-Off Wheels Fail? (Sometimes)." Explaining why abrasive wheels sometimes fail, and how to prevent such failures. Among the subjects considered are five common defects: Speed—can you have too much; spindle (or axle); flange; bearings; and motor—can a saw run too slowly? Also, various types of machines manufactured by the company are illustrated. This book can be obtained free on company letterhead request direct to the above address; otherwise at 50 cents per copy.

CYLINDRICAL ROLLER BEARINGS — Rollway Bearing Co., Syracuse, N. Y. Catalogue TR-854-DC, describing the Tru-Rol line of cylindrical roller bearings, listing types, sizes, dimensions, and load ratings. Included is a formula for load ratings, as well as a method of calculating expected bearing life, based on the formula of the Roller Bearing Engineers' Committee, Anti-Friction Bearing Manufacturers' Association. This catalogue can be obtained on request to the above address, giving business title.

SPEED REDUCERS—Brad Foote Gear Works, Inc., 1309 S. Cicero Ave., Cicero 50, Ill. Catalogue 120, consisting of 25 pages of helpful information on herringbone gear and spiral bevel-helical gear speed reducers, as well as giving concise instructions for choosing the speed reducer needed. Included are tables of horsepower ratings and dimensions of the five basic types. Also, assembly diagrams are given. Can be obtained on company letterhead request direct to the above address.

BAKELITE PLASTICS AND RESINS—Bakelite Co., a Division of Union Carbide and Carbon Corporation, 300 Madison Ave., New York 17, N. Y. 12-page booklet entitled "1955 Condensed Reference File of Bakelite Plastics and Resins," giving the latest information about properties and uses of more than fifty plastics and resins made by the company. Available to business firms upon direct request to the above address.

SHELL THREAD-ROLLING MACHINE—Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. Circular 833-EL-2, describing the company's automatic inclined shell thread-rolling machine, and explaining how the machine is normally used. Samples of some of the work that can be produced illustrate various types and sizes of threads. Can be obtained on company letterhead request direct to the above address.

PLANT LAY-OUT — Repro Templets, Inc., Oakmont (Allegheny County), Pa. Booklet entitled "The ABC of the Repro-Templet Method of Plant Lay-out," explaining the advantages of an efficient method of plant lay-out. An experimental sheet of Repro-Templets is included. Can be obtained on business letterhead request direct to the above address.

BALL-BEARING DIE SETS — Lempco Products, Inc., Bedford, Ohio. Catalogue 7, 192 pages listing over 300 sizes of ball-bearing die sets. A 16-page introduction outlines the advantages of ball-bearing guide-post design. There are eight sections—small precision die sets, all-steel; small super precision die sets; large precision die sets; large super precision die sets; ball-bearing guide-pin assemblies; precision die sets for use in multi-slide machines and Nilson four-slide machines; die accessories; and press- and tool-room equipment. 1

CARBIDE-TIPPED TOOLS — Cleveland Twist Drill Co., Cleveland, Ohio. 24-page catalogue containing helpful information on the use and care of carbide-tipped tools. Brief data are given on recommended feeds and speeds for carbide-tipped drills and reamers, together with illustrated instructions for grinding both types. Also described is the complete and

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enlarged Cleveland line of carbide-tipped drills; reamers; counterbores and spotfacers; and special carbide-tipped tools. 2

CHROME-NICKEL ALLOY STEELS—Carpenter Steel Co., Reading, Pa. Catalogue on two alloy steels—Carpenter No. 158, a casehardening steel; and No. 5-317, a hard- or tough-tempering steel, depending upon heat-treatment. Description of these alloys includes type analysis, physical properties, working instructions, and stock sizes available. Typical uses are also listed. A general guide tells when to use one steel in preference to the other. 3

TRAINING APPRENTICES FOR CRAFTSMANSHIP—Bureau of Apprenticeship, United States Department of Labor, Washington, D. C. Booklet entitled "Setting up an Apprenticeship Program," explaining in 32 pages how to go about setting up an apprenticeship program and what should enter into the training, as well as other pertinent material. Among other topics covered are the benefits of the G.I. Bill to veterans employed as apprentices and Selective Service regulations. 4

VACUUM-MELTED METALS AND ALLOYS—Carboloy Department of General Electric Co., Detroit, Mich. Technical bulletin VM-100, giving general information and technical data on vacuum-melted metals and alloys, as well as several commercial services now available in connection with such metals. Physical properties are tabulated. Also described is the Carboloy Alloy Development Service, which has been established to assist users of these new alloys. 5

FLUID POWER EQUIPMENT—Oilgear Co., Milwaukee, Wis. Bulletin 10051-D, illustrating and describing the company's complete line of fluid power pumps, motors, transmissions, cylinders, and valves. It features a new electric-hydraulic servo control system for pumps and transmissions up to 150 H.P., as well as a line of Oilgearducers for constant torque drives. Specifications are given. 6

BALL-BEARING CONVEYOR TROLLEYS—Link-Belt Co., Chicago, Ill. Book 2536, consisting of 20 pages in which the features of the company's new line of ball-bearing trolleys for overhead conveyors are described. The Series 500 trolleys are for use on 3-, 4-, or 6-inch I-beams in either bolted or riveted design. There are twelve illustrations of typical overhead trolley installations. 7

HIGH-STRENGTH LOW-ALLOY STEELS—International Nickel Co., Inc., New York City. Bulletin A-61, describing a group of high-strength, low-alloy steels—general characteristics, notch toughness, corrosion resistance, and how they are formed and worked. Design factors are discussed. These steels are finding rather wide application in those fields where a reduction in weight may mean savings in original and operating costs. 8

SOCKET SCREW PRODUCTS—Standard Pressed Steel Co., Jenkintown, Pa. 32-page catalogue entitled "Unbrako Standards," descriptive of Unbrako precision threaded fasteners. Dimensions and applications are given for the many types, such as socket head cap-screws, self-locking set-screws, shoulder screws, Dryseal thread pressure plugs, and socket screw keys. Cut-away drawings show special features of each product. 9

AUTOMATIC MILLING MACHINE — Producto Machine Co., Bridgeport, Conn. Bulletin on the new Producto Mill-Matic, a special-purpose automatic production milling machine. A detailed description is given of two design features—a rise-and-fall cutter-slide and a horizontal worktable with integral index mechanism. Typical tooling set-ups are illustrated and machine cycles shown. 10

VINYL BUTYRAL RESINS—Bakelite Co., a Division of Union Carbide and Carbon Corporation, New York City. Technical release No. 11, consisting of 27 pages comprising the latest information on properties and applications of Bakelite vinyl butyral resins. These resins are growing rapidly in use as wash primers (metal conditioners), wood and metal finishes, adhesives, and cloth coatings. 11

PLAIN CYLINDRICAL GRINDERS — Landis Tool Co., Waynesboro, Pa. Catalogue A-54, describing the Landis 4-inch, plain hydraulic grinder for precision cylindrical grinding operations. What the machine does and how it works are illustrated with many photographs and sketches. This grinder will handle a wide variety of small parts on long or short runs. 12

SHRINKING AND STRETCHING MACHINES—Engineering & Research Corporation, Riverdale, Md. Bulletin 183, describing Erco shrinking and stretching machines. Originally designed for shrinking operations on aluminum aircraft parts, such as producing double curvatures from flat sheets, these machines can also be used on various other metals, including mild and stainless steels. . . 13

VITRIFIED BONDED WHEELS — The Carborundum Company, Niagara Falls, N. Y. Booklet entitled "V40 for Tool-Room Grinding," describing a new line of vitrified bonded wheels developed specifically for tool-room operations, and listing hints for the conservation of tools. Included is a handy chart giving recommendations for grinding high-speed tool and die steels. 14

AUTOMATIC SPLICERS—E. W. Bliss Co., Salem, Ohio. Bulletin 43, describing the complete line of Weld-A-Matic coil splicers for welding ferrous or non-ferrous strip ranging from 8 to 94 inches in width. A typical continuous strip splicing line is shown, and a schematic diagram illustrates the operating principle. . . . 15

GEAR SETS—Cone-Drive Gears Division, Michigan Tool Co., Detroit, Mich. Catalogue 60--Section 700, consisting of 16 pages suggesting how standard Cone-Drive gear sets can be ordered in accordance with the specifications listed in the catalogue. Worm dimensions, gear and spider standards, tool charts, and horsepower ratings are given. 16

DIMENSIONAL INSPECTION — Federal Products Corporation, Providence, R. I. Booklet entitled "A Management Blind Spot," intended to show executives how dimensional inspection can save money in cutting down the losses which occur in every plant to some degree. Case histories show how proper dimensional control can influence the profit picture. 17

AIR TOOLS—Rotor Tool Co., Cleveland, Ohio. Catalogue 38-A, containing 55 pages of technical information on Rotor tools—screwdrivers, nutsetters, sanders,

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drills, and grinders. A new line of internal blade grinders is illustrated. Action photographs record savings realized in various plants by using these tools. **18**

MANUFACTURING FACILITIES—Rockford Tool & Die Works, Rockford, Ill. Folder illustrating the facilities of this company for manufacturing tools, dies, jigs, fixtures, and special machinery. Some of the precision-made tools and production parts made by the company are shown. A facility list is included. **19**

AUTOMATIC DRILL UNIT—Dumore Precision Tools, Racine, Wis. 16-page "Operations and Service Manual," describing the technical operations and maintenance of the new Dumore automatic drill unit, Series 24. A reference chart supplies information to facilitate rapid maintenance for the unit. **20**

POWER TRANSMISSION UNIT—Cleveland Worm & Gear Co., Cleveland, Ohio. Bulletin K-100, on the Cleveland Speed Variator—a simple, compact drive that provides infinitely variable output speed over a 9 to 1 range from a constant speed power source. The operating principle of this unit is explained by means of a schematic drawing. **21**

PROPORTIONAL POSITIONING CONTROLLER—Wheelco Instruments Division, Barber-Colman Co., Rockford, Ill. Bulletin F-6493, describing a Model 405 Capacitrol, which is used for continuous process applications requiring a true proportional relationship between fuel input and a continuously measured temperature. Scale range is given for various alloys. **22**

PRODUCTION MACHINES — Morris Machine Tool Co., Cincinnati, Ohio. This brochure consists of a folder describing basic Mor-Speed production machines, as well as twelve separate sheets giving case history details on specific applications. In each instance, the estimated cost of the operations performed is given. **23**

MECHANICAL TWO-POINT PRESSES—Cleveland Crane & Engineering Co., Wickliffe, Ohio. Catalogue 2018, featuring the new line of Steelweld two-point, straight-side, tie-rod presses. They range in capacity from 160 to 500 tons. Complete specifications and air-operated die cushion data are presented. **24**

HAND- AND FOOT-OPERATED VALVES—Ross Operating Valve Co., Detroit, Mich. Bulletin 303-B, describing the company's 600 and 880 series of hand- and foot-operated valves, giving installation data, parts lists, and exploded views of the valves to show the assembly relationship between parts. Air flow diagrams are also provided. **25**

ADJUSTABLE SPEED DRIVE—General Electric Co., Schenectady, N. Y. Bulletin GEA-6180, on the new "B" case, Speed Variator power unit, a packaged, all-electric, adjustable voltage, direct-current drive operating from alternating-current power. Information is provided on design and operating features, ratings, and dimensions. **26**

ALUMINUM EXTRUSION PROCESS — Precision Extrusions, Bensenville, Ill. 11-page circular describing the aluminum extrusion process, and showing six basic extrusion types illustrated by isometric drawings. A specification table lists physical properties and recommended applications for the fourteen most generally used alloys. **27**

GAGE-BLOCKS AND SPECIAL GAGES—Jansson Gage Co., Detroit, Mich. 19-page catalogue presenting the extended line of extreme-tolerance Jansson gage-block sets, sine bars, Tri-Squares, and accessory sets. The company's inspection service is outlined. Information is given on the care and maintenance of gage-blocks. **28**

HORIZONTAL BORING, DRILLING, AND MILLING MACHINES—Cincinnati Gilbert Machine Tool Co., Cincinnati, Ohio. Bulletin 954, containing 14 pages of technical information on floor type, horizontal boring, drilling, and milling machines. Specifications, operational photographs, and design details are presented. **29**

UNIVERSAL EXPANDING MANDRELS—Le Count Tool Works, Hartford, Conn. Folder covering two types of universal expanding mandrels—Type A, with concentricity within 0.0005 inch, total indicator reading; and Type S, with concentricity within 0.0002 inch, total indicator reading. **30**

SHOCK-VIBRATION ISOLATORS — Barry Corporation, Watertown, Mass. Bulletin 541, descriptive of Series 5200 Barrymount combination shock and vibration isolators, designed for application in the marine, transportation, and industrial fields. **31**

FAST-MACHINING LEADED ALLOY STEEL—Joseph T. Ryerson & Son, Inc., Chicago, Ill. Bulletin 14-5, describing Rycut 40, a chromium-molybdenum 0.40 per cent carbon steel. Average mechanical properties are listed, and several case studies are presented showing typical savings in cost of machined parts. . . **32**

CIRCULAR SAWING EQUIPMENT—Motch & Merryweather Machinery Co., Cleveland, Ohio. Booklet describing the Motch & Merryweather Triple-Chip method of circular sawing and the equip-

(Continued on next page)

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ment used—six sizes of sawing machines, automatic transfer machines, blade sharpeners, saw blade grinders, and sawing blades. 33

ROLLER LAPPING MACHINES—Spitfire Tool Co., Chicago, Ill. Leaflet describing the company's "12" precision centerless lapping machine, which will accommodate parts varying from 1/8 inch up to 6 inches in diameter by a simple adjustment of the rollers. 34

AIR CLUTCH—Dodge Mfg. Corporation, Mishawaka, Ind. Bulletin A-634, featuring the newly developed Dodge Air-Grip clutch. Tabular data include clutch and bore sizes, dimensions, weights, and list prices. 35

WELDERS—Sciaky Bros., Inc., Chicago, Ill. Bulletin 325-1, covering an air-operated, press type, three-phase spot welder and a projection welder, as well as a combination projection-spot welder. Design features are explained. 36

HARD-FACING ALLOYS—Wall Colmonoy Corporation, Detroit, Mich. Engineering data sheet No. 1A, describing special properties of Colmonoy hard-facing alloys. Also, there are two tables for use in estimating hard-facing alloy material requirements. 37

PILLOW BLOCKS AND FLANGE BEARINGS—Congress Drives Division, Tann Corporation, Detroit, Mich. Bulletin PB-54, describing a new line of low-cost, self-aligning pillow blocks and flange bearings, which feature the Permawick oil metering principle. 38

BROACHING FIXTURES — National Broach & Machine Co., Detroit, Mich. Catalogue B54-9, describing and illustrating Red Ring self-contained, air-powered bench type broaching fixtures. Included are several pages of "idea" line drawings of typical part shapes adapted to broaching on these fixtures. 39

TUNGSTEN ALLOY—Carboloy Department of General Electric Co., Detroit, Mich. Data sheet HV-4, covering the latest information on machinability and other physical properties of Hevimet, an alloy of tungsten, nickel, and copper produced by powder metallurgy. 40

REAMERS—Lavallee & Ide, Inc., Chicopee, Mass. Bulletin featuring the company's line of stock reamers, arranged by diameters in decimals from 0.0400 inch to 3.0000 inches. Every reamer is illustrated by type, shank, flute, length, list number, and price. 41

AUTOMATIC COPYING LATHE — H.E.B. Machine Tools, Inc., New York City. Leaflet descriptive of the Pilot multiple-cycle copying lathe, designed to operate completely automatically. Typical work examples are given, together with the production time. 42

WORM-GEAR MOTORS—D. O. James Gear Mfg. Co., Chicago, Ill. Catalogue 46-C, covering worm-gear motors for horizontal or vertical drive, with a ratio range of from 5.66 to 1 to 100 to 1 and from 1/8 to 30 H.P. Rating tables, dimensions, and prices are included. ..43

WAY LUBRICANT—Sun Oil Co., Philadelphia, Pa. Technical Bulletin 28, describing the Sunoco way lubricant, a high-quality mineral oil especially compounded to eliminate "stick-slip," as well as "floating" in the ways of machine tools. 44

STAINLESS-STEEL PIPING — Tubular Products Division, Babcock & Wilcox Co., Beaver Falls, Pa. Bulletin TB-356, outlining methods of bending and joining stainless-steel piping, and giving dimensions and weights of pipe sizes. 45

CAM CLUTCHES—Morse Chain Co., Detroit, Mich. Catalogue C11-54A and four reference sheets on the complete line of Morse cam clutches for indexing, overrunning, and backstop applications. Design features are explained. 46

TAPS AND DIES—Threadwell Tap & Die Co., Greenfield, Mass. Three price lists, featuring concise descriptions of the company's lines of taps, dies, counterbores, and keyway broaches. 47

SAFE GRINDING—Besly-Welles Corporation, Chicago, Ill. Booklet giving safety hints in grinding, showing in cartoon style the right and wrong ways to test, mount, and use grinding wheels and discs. 48

STEADYRESTS—Last Word Sales Co., Detroit, Mich. Leaflet describing three models of Gray-Grimes steadyrests, designed specifically to be used as work-supports in outside diameter grinding operations. 49

INDICATING CONTROLLER—Wheelco Instruments Division, Barber-Colman Co., Rockford, Ill. Bulletin F-5358-1, on the Model 292 Series Capacitrol for direct-reading control of temperatures up to 3000 degrees F. 50

MAGNETIC SCREW-HOLDING ACCESSORIES—Magna Driver Corporation, Buffalo, N. Y. 24-page manual on magnetic screw-holding accessories for power screwdrivers and nutsetters. 51

METAL BONDING PROCESS—Arthur Tickle Engineering Works, Inc., Brooklyn, N. Y. Booklet describing the "Alumicoat" process of bonding aluminum and its alloys to ferrous metals. 52

HARDNESS TESTER—Andrew King, Ardmore, Pa. Folder describing the King portable Brinell hardness tester, and explaining its ease of operation. 53

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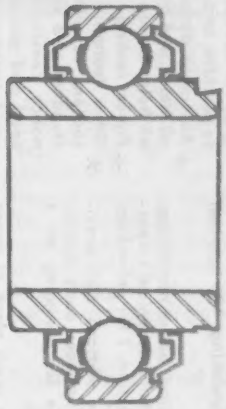
preference points on power transmission units

Seals that are EFFECTIVE...FRICTIONLESS

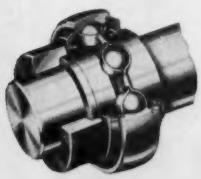


The Mechani-Seal consists of two "dished" steel plates. The inner member is fixed securely in the outer ring. The outer member is pressed on the outside diameter of the inner ring.

For applications where the bearing must be thoroughly protected against the entrance of foreign matter, or where grease must be absolutely retained within the bearing, the Fafnir Mechani-Seal Bearing offers definite advantages. This is the bearing you'll find in most Fafnir Ball Bearing Power Transmission Units.

The labyrinth design of the Fafnir-originated Mechani-Seal provides an inner trap seal for grease retention and an external rotating slinger for dirt exclusion. Close, but definite clearances between various seal members permit the bearing to "breathe". What's more, they insure it against drag, either in starting or running . . . no rubbing to introduce friction . . . no wear. Seals are integral with the bearing, are not subject to fouling or misalignment, and are corrosion and rust resistant.

When you compare design features, point for point, you can readily understand why the preference is for Fafnir Ball Bearing Power Transmission Units. For more details and a complete description of Fafnir Power Transmission Units call your Fafnir Representative. The Fafnir Bearing Company, New Britain, Conn.



WIDE INNER RING BALL BEARINGS . . . with Mechani-Seals

PILLOW BLOCKS . . . standard and heavy series

FLANGE CARTRIDGES . . . standard and heavy series

CYLINDRICAL CARTRIDGES . . . standard and heavy series

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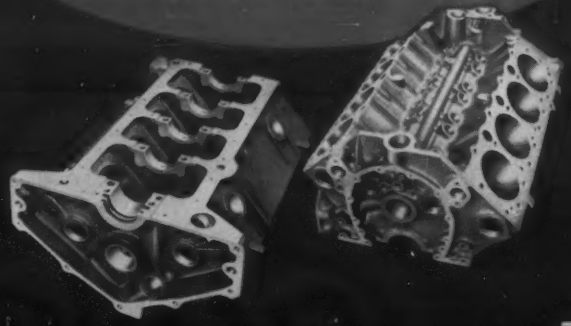
BALL BEARINGS
MOST COMPLETE LINE IN AMERICA

350 Foot Automation Line Performs 555 Operations on V-8 Cylinder Blocks

Another Transfer-matic by Cross



- ★ 100 pieces at 100% efficiency.
- ★ Operations: 265 drilling, 6 milling, 21 boring, 56 reaming, 101 countersinking, 106 tapping, and 133 inspection.
- ★ 104 stations: 1 for loading, 53 for machining, 7 for part handling, 6 for mechanical inspection, 36 for visual inspection, 1 for unloading.
- ★ 5 independent machine sections with provision for banking parts between each section; master automatic cycle for operating all 5 sections simultaneously.
- ★ Capacity for removing work piece at every station.
- ★ Automatic independent transfer mechanism for each machine section and automation units for handling parts from machine section to machine section.
- ★ Automatic air pressure test for high pressure oil holes and automatic depth inspection for all holes before tapping.
- ★ Pre-set tooling throughout.
- ★ Other features: Coolant system for tapping section, complete interchangeability of all standard and special parts for easy maintenance, construction to J.I.C. standards, hardened and ground ways, hydraulic feed and rapid traverse, automatic lubrication, automatic chip disposal.

Established 1898

THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

By E. S. Salichs

The Best of Cheer in the Coming Year

is our Christmas greeting to all of MACHINERY'S readers. We hesitate to mention this (governed, as we are, by that terse motto about self-praise), but the fact is that one of our readers, while writing us a letter commenting on a certain inaccuracy of ours, softened the blow with his opening sentence, "Your page is a favorite relaxing spot in a powerhouse of technical reading." We shall work for this goal in 1955; we hope you have one equally as pleasant.

Mr. Lester's Page

"Talking with Sales Managers" will be the title of Bernard Lester's monthly page in MACHINERY beginning with January, instead of "The Sales Engineer and His Problems." Because of the many changes taking place in selling industrial equipment, sales managers' problems have become more varied and pressing. They have a definite relation to sales performance at the sales engineers' level. In extending the scope of his articles, Mr. Lester wants it made clear that he is not abandoning the sales engineer to his perplexities. Not after seven years of adeptly solving them!

Facing the Spacing

Referring to our October issue, the Editor's name and the title of his editorial were run together in the table of contents due to not instructing the printer to insert a space between them. The result read, "Accelerated Depreciation Finally Authorized By Charles O. Herb." As an aftermath, an executive in a huge automotive concern wrote to the Editor with the comment that his company had been waiting for years to get accelerated depreciation and he was delighted that someone he knew had enough guts to do it.

Plastic Powdered Snow

On film, Mother Nature's snow just doesn't look like snow. So Hollywood adopted substitutes, such as treated, bleached cornflakes. But now there is a plastic product on the market, Styrofoam. Stanley Cortez, one of the foremost cameramen, said recently in a news release, "When I want to photograph a good romp in the snow, give me Styrofoam. Why, it even looks colder."

DEAR SANTA, That's me in the picture. I'm at the General Electric Co. in Skenec, Skenek, in New York, that is, and Mr. Frank Sherman is showing me a scale model of a 166,000-pound generator rotor being lifted by a model crane. I'm pushing the buttons. Santa, that crane is complete with electrical controls, miniature motors, pulleys, hooks, cables, and slings. G-E is using it to teach people who operate cranes how to safely lift units weighing anywhere from 2 to 234 tons, maybe costing as much as half a million dollars apiece. Please, Santa, now that I know how to run one, can I have a crane just like that for Christmas? Hopefully, Sonny

Calling Contestants—Have You Read Page 210?

News OF THE INDUSTRY

California and Texas

C. D. D'AMICO has been named manager of sales in the Los Angeles, Calif., plant of Joseph T. Ryerson & Son, Inc., Chicago, Ill. He succeeds C. H. HALLETT, who is moving to the Ryerson plant in Chicago for special assignment. Mr. D'Amico was formerly manager of the Los Angeles stainless steel department, this position now being filled by F. X. KINZIE, who formerly was a sales representative for this department.

FOXBORO CO., Foxboro, Mass., manufacturer of industrial instruments, has opened a service and assembly building in San Leandro, Calif., located at 399 Preda St. This factory more than doubles the company's West Coast manufacturing facilities, providing 8400 square feet of space.

FELLOWS GEAR SHAPER CO., Springfield, Vt., recently established a branch office at 5 Martel Bldg., 6214 W. Manchester Ave., Los Angeles, Calif. FRANK D. SANBORN will be western district manager.

ALBERT ANFORTH has been appointed a representative by the Brown & Sharpe Mfg. Co., Providence, R. I., assuming responsibility of the Los Angeles, Calif., office.

DU BOIS EASTMAN has been appointed director of research at the Montebello, Calif., research laboratory of the Texas Co., New York City.

C. T. ANNE was recently named superintendent of the research laboratories at Port Arthur and Port Neches, Tex., by the Texas Co., New York City, while H. D. MASSIN was made director of research.

Illinois and Indiana

E. P. CUNNINGHAM and ALBERT CLEMENTS have been appointed vice-presidents by the Clearing Machine Corporation, Division of U. S. Industries, Inc., Chicago, Ill. Mr. Cunningham will be vice-president in charge of sales. He joined the staff twenty years ago and has spent practically all of that time in sales work. Most recently he was general sales manager for Clearing. Mr. Clements was general manager of the Hamilton, Ohio, plant, which he will now head as vice-president. He has been located at the Ohio plant since 1952, prior to that having been chief engineer of the Chicago division.

(Left to Right) E. P. Cunningham and A. Clements, new vice-presidents of the Clearing Machine Corporation, Division of U. S. Industries, Inc.

PAUL KJELSTROM was recently made manager of the Service and Parts Division of the Verson Allsteel Press Co., Chicago, Ill. Mr. Kjelstrom has been associated with the company since 1942, most recently as chief engineer, production engineering. Also announced was the appointment of JACK STEINHARDT to the post of assistant manager in this division.

Paul Kjelstrom, manager of the Service and Parts Division, Verson Allsteel Press Co.

BARBER-COLMAN CO., Rockford, Ill., announces the purchase of the HENDEY MACHINE CO., Torrington, Conn., except for its manufacturing facilities. It will henceforth be known as the HENDEY MACHINE DIVISION OF BARBER-COLMAN CO. and will manufacture the complete line of Hendey tool-room and manufacturing lathes and shapers. Manufacturing operations will begin at the Barber-Colman plant in Rockford within the next two or three months. Temporarily, parts, sales, and service are available through either organization.

BEN A. FLEURY has joined the Union Twist Drill Co., Athol, Mass., in the capacity of Chicago, Ill., district manager. Mr. Fleury was formerly connected with the Charles Products Co., Chicago, where he was vice-president for the last two years.

J. A. SCHAEFER was recently elected to the newly created post of executive vice-president of Dreis &

Small Gearmaking is a Fine Art at G.S.
G. S. has attained a degree of accuracy long considered impossible in the mass-manufacture of Small Gearing. Whether your needs run in hundreds or thousands, *each* Gear proves so uniformly accurate that rejects are no longer a problem.
Think of the time and money that saves . . in assembly work . . in returned goods . . in the greater satisfaction of your trade and your users. ★ The finer, more uniform quality of G. S. Gearing has been recognized for more than 38 years. But, never so highly valued as NOW! Increasingly competitive conditions demand *better* components . . better performance in *EVERY unit you produce.* ★ More and more manufacturers from coast-to-coast are turning to the extremely accurate Gearing we make. Let our capable staff work with you, too, on the very next order you place.
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Specialties, Inc.
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SPURS • SPIRALS • HELICALS • BEVELS • INTERNALS
WORM GEARING • RACKS • THREAD GRINDING
WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARING
Gear Specialties
GEAR Specialties, Inc.
GET G.S. TECHNICAL DATA Free!
See where and how we mass-manufacture Small Gearing to uniformly fine tolerances. Folder contains 23 pictures of Small Gears, plant views, as well as Diametral and Circular Pitch Tables. Ask for your copy on company stationery, please!

J. A. Schaefer, who is executive vice-president of the Dreis & Krump Mfg. Co.

Krump Mfg. Co., of Chicago, Ill., manufacturer of bending brakes and press brakes. Mr. Schaefer was sales manager before his promotion.

RICHARD H. BERGSTRAND, assistant chief design engineer of the Moline Tool Co., Moline, Ill., has been promoted to the post of chief design engineer. Mr. Bergstrand has been in the engineering department for nineteen years.

INDUSTRIAL CRANE & HOIST CORPORATION recently moved from 315 N. Ada St. to enlarged office and plant facilities at 1536 S. Paulina St., Chicago, Ill.

CARL W. PETERSEN has been elected vice-president and works manager of the Dodge Mfg. Corporation, Mishawaka, Ind. EDGAR M. CARVER, who was first vice-president of Dodge, recently retired, although continuing to serve as a member of the board of directors. Mr. Carver has been associated with the concern for over forty-five years.

MRS. E. P. WILKINSON, president of the Logansport Machine Co., Inc., Logansport, Ind., recently resigned from this position and was elected chairman of the board. C. H. WILKINSON was elected president, E. L. KIMES, vice-president and treasurer; and L. L. AUSTIN, vice-president and secretary.

Maryland, Kentucky, and Alabama

ACF INDUSTRIES, INC., New York City, has acquired the ENGINEERING & RESEARCH CORPORATION, Riverdale, Md. Erco, as the newly acquired concern is known, is presently engaged in the production of electronics and airplane equipment.

WESSON METAL CORPORATION, Lexington, Ky., producer of carbide steels, announces the following appointments: JAMES H. JOHNSON has been assigned to the Cleveland, Ohio, area and DONALD E. HAMILTON has joined the company as a representative in the Illinois district. Mr. Hamilton was formerly associated with the Austin Western Co., Aurora, Ill., where he was a methods engineer.

ALLEN-BRADLEY CO., Milwaukee, Wis., manufacturer of manual and automatic motor controls as well as electronic components, has appointed the JAMES L. HOWARTH CO., INC., as Alabama sales representative. The James L. Howarth Co., Inc., is located at 3021 Seventh Ave., Birmingham, Ala., and is a newly incorporated sales agency with JAMES L. HOWARTH as president and R. S. MORRISON as vice-president. Mr. Morrison was previously a sales engineer for W. H. Beaven, former Allen-Bradley Birmingham sales agent, and is therefore familiar with the company's line.

NORTON CO., Worcester, Mass., has announced the expansion of its electric furnace facilities by building a plant in Huntsville, Ala. Completion of the project is expected by the end of 1955. Over-all operation of the new plant will be directed by HOWARD J. DALY, Norton's electric furnace plant manager in Chippawa, Ontario.

Michigan

MORSE CHAIN CO., subsidiary of the Borg-Warner Corporation, Chicago, Ill., operating plants at Ithaca, N. Y., and Detroit, Mich., announces a reorganization as follows: LOUIS PAUL SMITH, who was vice-president and Ithaca plant manager, has been named vice-president of manufacturing operations of the entire company; and NORMAN C. BREMER, previously chief engineer at Ithaca, has taken on the additional duties of chief engineer at the Detroit plant.

T. J. AULT has been elected president and general manager of the Long Mfg. Division, Detroit, Mich., of the Borg-Warner Corporation, Chicago, Ill. J. RODGER DRYDEN, who held this position, becomes chairman of the board of the Division, succeeding J. LESTER DRYDEN, who is retiring. For the present, Mr. Ault also retains the position of president and general manager of the Detroit Gear Division.

B. E. LOGSDON has joined the Gairing Tool Co., Detroit, Mich., in the capacity of sales engineer on machine tool applications and special assignment. Mr. Logsdon will have his headquarters at Detroit. He was formerly chief engineer of the Sheldrick Mfg. Co., Upper Sandusky, Ohio.

WILLIAM J. HERRMANN has been appointed factory manager of the Detroit plant of Vickers Incorporated, Detroit, Mich. He joined the company in 1946 as a senior engineer assigned to industrial product design, and two years later, became administrative assistant to the engineering manager. For the last three years, Mr. Herrmann has held the

William J. Herrmann, who is factory manager of Vickers Incorporated

position of administrative assistant to the vice-president. Also announced were the appointments of GILBERT L. STANCLIFF, JR., as manager, and CHARLES J. CANNON, assistant manager, of the Federal Contracts sales department.

CARL J. RICKER has been appointed chief sales engineer in the Hastings Division, Hastings, Mich., of the E. W. Bliss Co., Canton, Ohio. He replaces GUY PRETTYMAN, who recently retired.

JANSSON GAGE CO. recently moved to a new and larger plant, located at 13550 Auburn, Detroit 39, Mich.

New England

CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa., recently opened its new branch sales office and warehouse at 285 State St., North Haven, Conn., which occupies

(*Continued on page 259*)

the fastest piloted airplane in the world . . . flying at more than 1650 miles per hour, or more than two and one-half times the speed of sound

BELL AIRCRAFT CORP.
BUFFALO, NEW YORK

SIDNEY *Heavy-Duty* LATHES

the fastest precision lathes . . . often saving more than two and one-half times on costs

photographed in the plant of BELL AIRCRAFT CORPORATION BUFFALO, NEW YORK

DON'T LET OBSOLETE LATHES PUT YOU OUT OF THE RUNNING

LET **SIDNEY LATHES** REDUCE PRODUCTION COSTS

ACCURACY

amazing accuracy assured. The Sidney Fluid Tracer Lathe on diameters and shoulder work repeats to extremely close tolerances as many times as desired.

PRODUCTIVITY

work formerly requiring long, tedious hours is now done in minutes.

SIMPLICITY

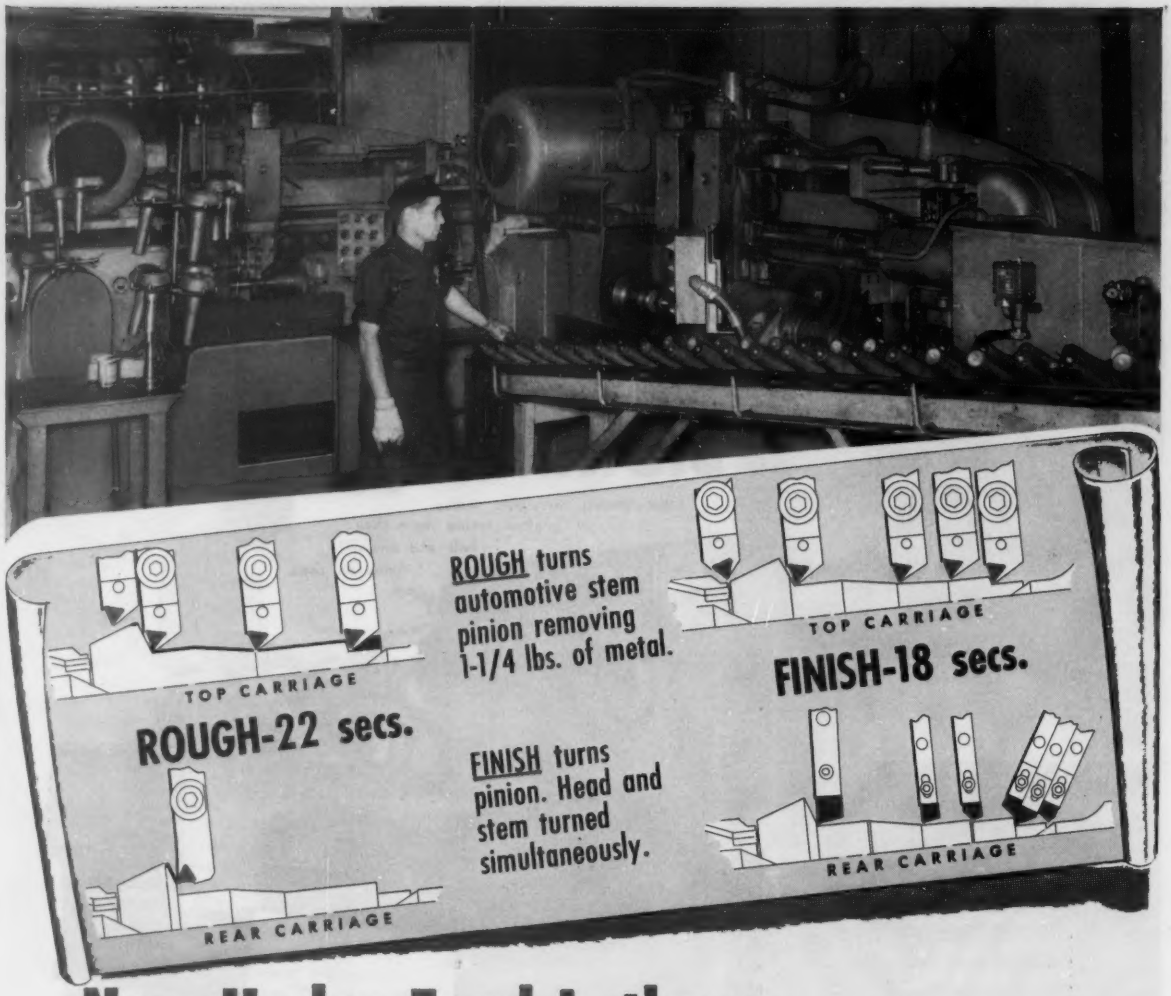
within 2 or 3 seconds Sidney Fluid Tracer Lathes can be converted to standard lathe operation and vice versa.

Write for bulletins

THE SIDNEY MACHINE TOOL COMPANY — 50th Year — SIDNEY • OHIO

THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904



New Hydra-Feed Lathes Cut Pinion Machining Costs . . .

Only 2 Hydra-Feed lathes are required to completely R & F turn stem pinions (SAE 4620) at the plant of one of the major automobile producers. Time has been cut, floor space saved, capital investment reduced and chance of errors minimized.

Hydra-Feed lathes are today's answer to these requirements:

Maximum carbide performance (cam or tracer control)
Easy loading or automation (no front obstruction)
Maximum rate of metal removal (short tool travel, too)
Decreased maintenance (J.I.C. throughout)
Smoothness (downward tool pressures and massive design)

Let us tell you . . .

the Hydra-Feed story and how it can cut your costs, improve your quality.

. . . Ask for catalog

HYDRA-FEED MACHINE TOOL CORPORATION

SOUTH NORWALK, CONNECTICUT AND DETROIT (Ferndale), MICHIGAN

Address all inquiries to

SALES AND ENGINEERING OFFICE, 730 W. EIGHT MILE ROAD, FERNDALE, MICHIGAN

For more information on products advertised, use Inquiry Card, page 245

MACHINERY'S DATA SHEETS 767 and 768

PRESSURE IN TONS PER LINEAR FOOT REQUIRED FOR ANGLE BENDING — 5

Table Gives Pressures for "Air Forming" Method Used on Press Brake Employing Dies Having Die Member Openings of Different Widths

Thickness of Metal		Width of Opening in Die Member, Inches											
Size	Inch	5	5 1/4	5 1/2	6	6 1/2	7	7 1/2	8	8 1/2	9	12	16
5/16	0.312	8.4											
11/32	0.343	10.3	9.8	9.2									
3/8	0.375	12.5	11.7	11.1	10.1								
13/32	0.406	14.7	13.9	13.2	12.0	11.0							
7/16	0.437	17.2	16.3	15.5	14.1	12.9	11.8						
15/32	0.468	20.0	19.0	17.9	16.2	14.8	13.7	12.6					
1/2	0.500	23.0	21.8	20.6	18.6	17.0	15.7	14.5	13.5				
17/32	0.531	26.2	24.8	23.6	21.4	19.4	17.9	16.5	15.4	14.4			
5/8	0.625	**37.3**	35.2	33.2	30.1	27.7	25.3	23.2	21.6	20.3	19.0		
11/16	0.687	46.8	43.5	**41.0**	37.1	33.7	31.0	28.5	26.5	24.9	23.3		
3/4	0.750	60.8	53.2	49.7	**44.8**	41.0	37.4	34.6	32.2	30.0	28.0	20.2	
13/16	0.812	77.5	68.0	60.5	53.5	**48.6**	44.5	41.2	38.0	35.6	33.3	24.0	
1	1.000	....	....	....	97.8	83.0	71.0	64.8	**59.8**	55.8	51.9	37.2	27.0

Note: For instructions in the use of this Data Sheet see Data Sheets Nos. 763, 764, and 765 published in October and November MACHINERY.

MACHINERY'S Data Sheet No. 767, December, 1954

Compiled by Verson Allsteel Press Co., Chicago, Illinois

AMERICAN STANDARD BUTTRESS SCREW THREADS — 1

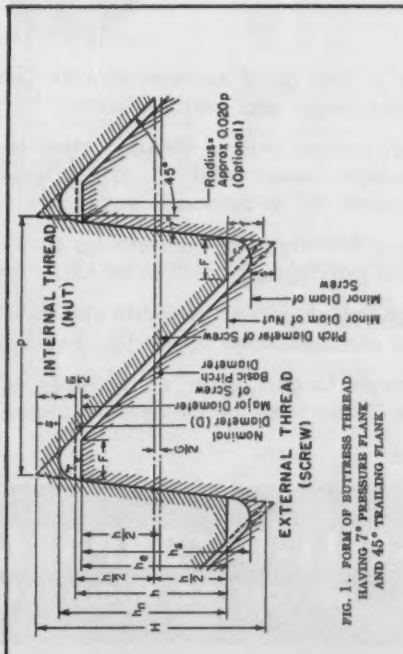


FIG. 1. FORM OF BUTTRESS THREAD HAVING 7° PRESSURE FLANK AND 45° TRAILING FLANK

The following suggestions are made regarding suitable associations of diameters and pitches:

Diameter Range (Inches)	Associated Pitches (Threads per Inch)	
From 1/4 to 1 1/16	20, 16, 12	Over 2 1/2 to 4 — 16, 12, 10, 8, 6, 5, 4
Over 1 1/16 to 1	16, 12, 10	Over 4 to 6 — 12, 10, 8, 6, 5, 4, 3
Over 1 to 1 1/2	16, 12, 10, 8, 6	Over 6 to 10 — 10, 8, 6, 5, 4, 3, 2 1/2, 2
Over 1 1/2 to 2 1/2	16, 12, 10, 8, 6, 5, 4	Over 10 to 16 — 10, 8, 6, 5, 4, 3, 2 1/2, 2, 1 1/2, 1 1/4, 1
		Over 16 to 24 — 8, 6, 5, 4, 3, 2 1/2, 2, 1 1/2, 1 1/4, 1

Basic dimensions for each of the foregoing pitches are given in Table 1.

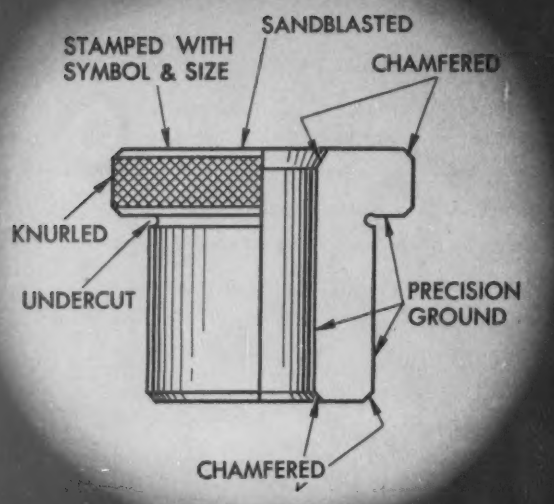
Table 1. Basic Dimensions for Buttress Screw Threads

Threads per Inch	Pitch, p	Basic Depth of Thread, h = 0.6p	Depth of Sharp-V Thread, H = 0.80064p	Crest Truncation, f = 0.14532p	Depth of Thread, h or h' = 0.66271p	Root Truncation, r = 0.66261p	Root Radius, r = 0.07141p	Width of Flat at Crest, f = 0.18316p
20	0.0500	0.0300	0.0445	0.0073	0.0331	0.0041	0.0036	0.0092
16	0.0625	0.0375	0.0557	0.0091	0.0414	0.0052	0.0045	0.0115
12	0.0833	0.0500	0.0742	0.0121	0.0552	0.0069	0.0059	0.0153
10	0.1000	0.0600	0.0891	0.0145	0.0663	0.0083	0.0071	0.0183
8	0.1250	0.0750	0.1115	0.0182	0.0829	0.0103	0.0089	0.0229
6	0.1667	0.1000	0.1484	0.0242	0.1105	0.0138	0.0119	0.0271
5	0.2000	0.1200	0.1781	0.0291	0.1325	0.0165	0.0143	0.0324
4	0.2500	0.1500	0.2227	0.0363	0.1657	0.0207	0.0179	0.0408
3	0.3333	0.2000	0.2969	0.0484	0.2209	0.0275	0.0238	0.0543
2 1/2	0.4000	0.2400	0.3563	0.0581	0.2651	0.0330	0.0286	0.0653
2	0.5000	0.3000	0.4453	0.0727	0.3314	0.0413	0.0357	0.0816
1 1/2	0.6667	0.4000	0.5938	0.0969	0.4418	0.0551	0.0476	0.1088
1 1/4	0.8000	0.4800	0.7125	0.1163	0.5302	0.0661	0.0572	0.1305
1	1.0000	0.6000	0.8906	0.1453	0.6627	0.0826	0.0714	0.1632

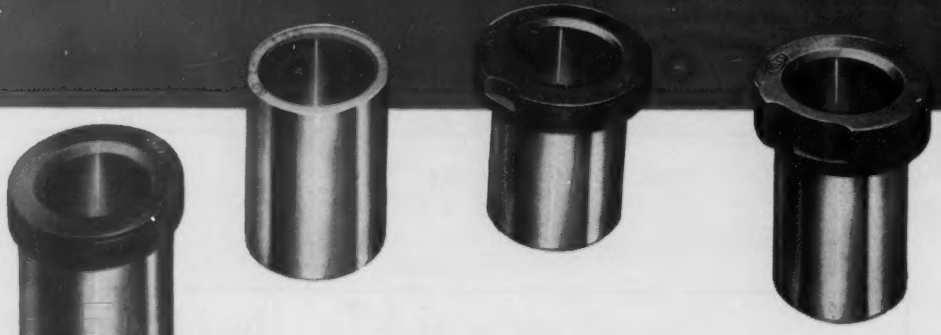
* All other dimensions are given in inches.
For key to designation symbols, see Fig. 1.

MACHINERY'S Data Sheet No. 768, December, 1954

Extracted from ASA B1.9—1953 with permission of publisher, American Society of Mechanical Engineers



THE INSIDE STORY OF EX-CELL-O DRILL JIG BUSHINGS



Here are a few good reasons why Ex-Cell-O Drill Jig Bushings last longer and perform better:

1. High carbon chrome bearing steel is selected for maximum wear and deep-hardened to 62-64 Rockwell "C" in automatic equipment.
2. Every bushing must measure up to Ex-Cell-O precision standards, as well as to A.S.A. standards.
3. High finish is ground on inside and outside diameters, and *under the head* for perfect bearing.

The country's largest users of bushings are Ex-Cell-O customers. Order from the Ex-Cell-O Catalog.

To satisfy the needs of your purchasing and engineering departments be sure to have an adequate supply of Ex-Cell-O Bushing Catalogs. Ask for the number of copies you need.

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EX-CELL-O for PRECISION

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MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

54-34

an area of 16,000 square feet. The warehouse will stock a full line of Crucible tool steels, stainless and alloy steels, welding rods, machinery steels, and other specialty products. The branch also sells, but does not stock, products of the Trent Tube Co., the Rem-Cru Titanium Corporation, and the Vacuum Metals Corporation.

JOHN C. GEARY has been named a special sales representative, stainless division, by the Crucible Steel Company of America, Pittsburgh, Pa. Mr. Geary has been assigned to the New England territory with headquarters in New Haven, Conn.

REID BROTHERS CO., INC., Beverly, Mass., manufacturer of precision grinders and machine tools, announces the appointment of the following distributors: MODERN MACHINERY SALES CO., 1565 W. 12th St., Erie, Pa.; and MOORE BROTHERS MACHINERY CO., LTD., 953 St. James St., West, Montreal, Canada.

RAYMOND H. MATTHEWS has been made chief engineer of Fenwal, Inc., Ashland, Mass., manufacturer of precision temperature control devices. Mr. Matthews was formerly assistant chief engineer.

EARL P. LEEDS has become director, industrial products sales, for the Brown & Sharpe Mfg. Co., Providence, R. I. Mr. Leeds, who was formerly in machine tool sales, will be responsible for the sale of all small tool, cutter, and general goods items.

New York and New Jersey

TEXAS CO., New York City, announces the appointment of the following men in its Research and Technical Department: DR. WAYNE E. KUHN, general manager; W. A. MCMILLAN, assistant general manager; and GUS KAUFMAN, manager —operations. In the Research Division, W. J. COPPOC was named manager of research; T. C. HEISIG, assistant manager of research (products); and C. E. MOSER, assistant manager of research (process). In the Technical Services Division, new assignments are as follows: R. W. HALL, manager of technical services; and assistant managers of technical services—A. L. BRODIE (automotive); M. L. LANGWORTHY (manufacturers' service); and R. R. THURSTON (industrial products). The following have been named regional managers—technical services: B. Y. MCCARTY, Chicago, Ill.; C. E. EMMONS, Los Angeles, Calif., and O. P. PURYEAR, Houston, Tex.; K. L. HOLLISTER is technical representative for the Department in Detroit.

PRESSED STEEL CAR COMPANY, INC., New York City, has announced adoption of a new name—U. S. INDUSTRIES, INC. This change is the result of an extensive diversification program that has taken the company away from the freight car business into new and varied fields. Earlier this year, the company closed its last freight car building plant at Mount Vernon, Ill. Sometime ago, it began buying steel fabricating companies. Then, it turned its Hegewisch, Ill., plant, originally a car building shop, into a tank and armored vehicle depot. In 1952, the company acquired the Axelson Mfg. Co. of Los Angeles, Calif., and St. Louis, Mo.; and this October, the Clearing Machine Corporation, Chicago, Ill.

F. LOOMIS LAMPREY has been named manager of mechanical engineering for the construction engineering section of the General Electric Co., Schenectady, N. Y. As manager, Mr. Lamprey will coordinate engineering activities involving the design and construction of power generation projects such as steam, gas turbine, and atomic energy plants. Also announced was the appointment of EDWARD H. FREIBURGHOUSE, JR., as manager of the new mechanical engineering sub-section in the G-E Materials and Processes Laboratory.

PHILIP W. CHASE was recently appointed assistant vice-president—raw materials, United States Steel Corporation, New York City. He succeeds H. D. MOULTON, who was recently elected president of United States Steel Homes. At the time of his appointment, Mr. Chase was director—exploration and development, in Pittsburgh. AUGUST J. BREITENSTEIN will now assume the responsibilities of this position, in addition to the one he now holds, director of planning in the Raw Materials Division.

VACUUM METALS CORPORATION, jointly owned by the Crucible Steel Company of America and the National Research Corporation, is moving its vacuum melting production facilities from Cambridge, Mass., to Syracuse, N. Y. JAMES H. MOORE has been appointed general manager of the Syracuse offices, and ALFRED H. LEWIS, sales manager. Mr. Lewis was formerly branch sales manager at Syracuse for Crucible.

WILLIAM H. SPARR, JR., has been placed in charge of the steel section of the nickel sales department of the International Nickel Co., Inc., New York City, Mr. Sparr, who joined the company in 1946, was previously head of the technical field section of the Development and Research Division in Pittsburgh, Pa. This position will now be filled by GEORGE L. HOOBLER. Mr. Hoobler, with Inco since 1947, was in the ductile iron section in New York since 1951.

THEODORE I. DUNN, JR., has been appointed assistant vice-president of sales for the Russell, Burdsall & Ward Bolt and Nut Co., Port Chester, N. Y. Mr. Dunn, who has been with the company since 1936, was formerly Pacific Coast sales manager. His chief responsibility now will be supervision of eastern sales. Mr. Dunn will be succeeded by JAMES M. BELL as Pacific Coast sales manager.

PRATT & WHITNEY, Division Niles-Bement-Pond Co., West Hartford, Conn., announces that its New York office has been moved to 42-19 Main St., Flushing, N. Y. This office maintains comprehensive stocks of Pratt & Whitney cutting tools and gages; and provides customer service in metropolitan New York, Long Island, northern New Jersey, eastern New York State, and southern Connecticut.

HARRY H. ROSE, general manager of the Simmons Fastener Corporation, Albany, N. Y., has been appointed vice-president and director. Mr. Rose will also continue as general manager, a position he has held since 1949. Before his affiliation with this concern, Mr. Rose was an engineer for the parent company, the Simmons Machine Tool Corporation, also of Albany.

C. E. CUMMINGS has been named superintendent of the Beacon, N. Y., laboratories of the Texas Co., New York City. Other appointments there include R. L. SAWYER, director of research; R. E. CONARY, assistant director of research; and BRUCE HEGEMAN, director of technical services.

RUDOLPH W. GLASNER, president of the Clearing Machine Corporation, Chicago, Ill., a division of U. S. Industries, Inc., New York City, has been elected a director and vice-president of U. S. Industries, Inc.

AMERICAN BOSCH CORPORATION and its subsidiary, ARMA CORPORATION, having legally been merged, will be known as the AMERICAN BOSCH ARMA CORPORATION, Garden City, N. Y.

CARPENTER STEEL CO., Reading, Pa., announces the transfer of four sales representatives in the Alloy Tube Division, Union, N. J., as follows: C. DONALD STEINWEDEL has moved from Charlotte, N. C., in the mideastern sales region to Union, where he will serve as assistant mill superintendent. THOMAS J. BRENNAN, who was in Houston, Tex., will now be at Charlotte. GEORGE A. DAVIS, formerly in the New England district of the eastern region, will become sales representative in the Houston area in the western division; and ARVIN W. HARRINGTON has been assigned to the New Eng-

land district in addition to his present territory of metropolitan New York and part of New York state.

HARRY ENGVALL, formerly chief engineer of the turbine and gear departments of the De Laval Steam Turbine Co., Trenton, N. J., has been promoted to executive engineer. The post he vacated will be assumed by JOHN S. HAVERSTICK.

J & S TOOL CO., INC., Livingston, N. J., has acquired the manufacturing and distributing rights to the Jahrl milling chuck in the United States. It will be known here as the J & S Jal milling chuck.

Ohio

ROBERT POTTER, who was vice-president and manager of the Salem, Ohio, Division of E. W. Bliss Co., Canton, Ohio, is assuming the office of assistant executive vice-president. He will be located at Canton, and will assist in the general supervision of the manufacturing divisions and subsidiaries. Mr. Potter has been manager of the Salem Division since 1946. Also, GEORGE PERRAULT, JR., sales manager of the Rolling Mill Division at Salem, will become manager of the Salem Division. Mr. Perrault has been with Bliss since 1949. C. A. CHAMBERLAIN, assistant to the president, at Canton, has been appointed secretary in addition to his present duties.

Fabian Bachrach

Robert Potter, new assistant executive vice-president of the E. W. Bliss Co.

GRIFFITH C. TAAFFE, vice-president of the Cincinnati Lathe & Tool Co., Cincinnati, Ohio, has been elected president of the company. He joined the organization as sales manager in 1947, and two years later, became vice-president. Mr. Taaffe replaces MILLARD ROMAINE, who has served as president since 1945 but has now left for Europe to start the Netherlands plant of the Cincinnati Milling Machine Co. Mr. Romaine will continue, however, as a member of the board of directors of the Cincinnati Lathe & Tool Co. and a vice-president of the Cincinnati Milling Machine Co.

Griffith C. Taaffe, president of the Cincinnati Lathe & Tool Co.

CHEEVER H. ELY has been appointed district manager at Cleveland, Ohio, by the Norton Co., Worcester, Mass., replacing FRED P. HAYS, who is retiring after thirty-eight years of service with the company. Mr. Ely has been with Norton since 1927. He was formerly abrasive engineer in the Dayton, Ohio, area, this position now being filled by WILLIAM C. DAVIDSON. Mr. Davidson was formerly abrasive engineer in West Virginia.

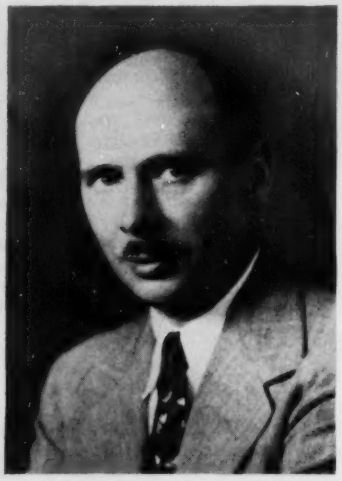
ROBERT E. LUTZ has been named manager of the Cincinnati, Ohio, zone sales office of the New Departure Division, General Motors Corporation, Bristol, Conn. He succeeds DUDLEY W. NEARING, who is now serving the New Departure sales organization as a specialist in applications of New Departure ball bearings in the machine tool field. Mr. Nearing will continue to make his headquarters at the Cincinnati office.

CARPENTER STEEL CO., Reading, Pa., recently opened a new mill-branch warehouse and office in Dayton, Ohio, located at 229 Leo St. The office is under the supervision of W. C. KUNKELMAN, southeastern district manager. R. P. UHL, branch manager, is in charge of the warehouse and office.

SAM J. FORBES, president of the P. O. McIntire Co., Cleveland, Ohio, manufacturer of Pomco boring and reaming tools, was recently elected chairman of the board of directors, while CHARLES D. SHANNON, formerly vice-president and general manager, was appointed president. ALFRED G. GOGLIN, superintendent, wa made vice-president and general manager.

FEDERAL FAWICK CORPORATION, Cleveland, Ohio, has changed its name to the FAWICK CORPORATION. The concern manufactures brakes and clutches for heavy industrial machinery.

RALPH E. DITTOE, assistant secretary of the Cleveland Worm & Gear Co., Cleveland, Ohio, was recently appointed to serve also as sales manager in the Worm Gear Division. Mr. Dittoe has been with the organization since 1919, serving in recent years as assistant sales manager. He is also a director.



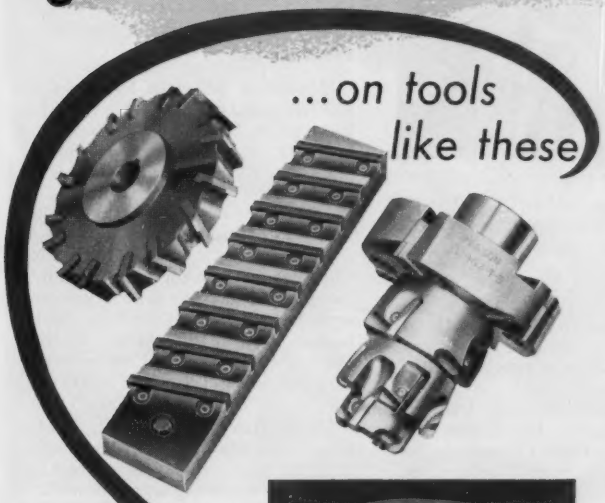
Ralph E. Dittoe, sales manager of the Worm Gear Division, Cleveland Worm & Gear Co.

HARRISON O. ASH was recently elected president and general manager of Aluminum Industries, Inc., Cincinnati, Ohio. He succeeds JOHN W. CRAIG, who resigned in November to join RCA.

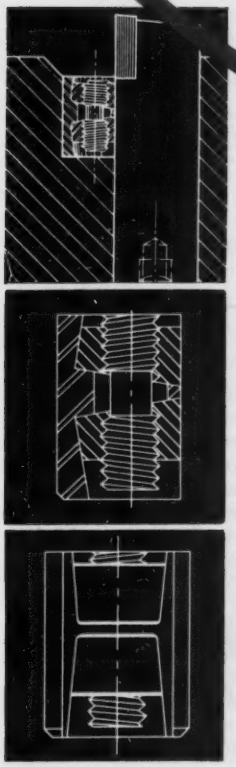
WALTER E. CALLISON, a sales engineer with the Steel Products Engineering Co., Springfield, Ohio, was recently named assistant manager of the Brehm Division, a newly created position.

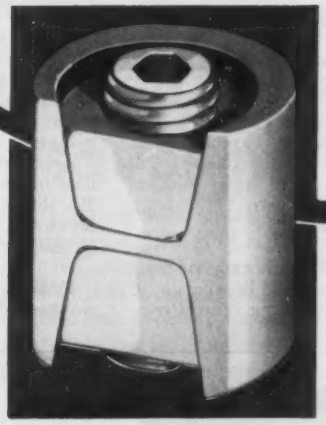
MONARCH MACHINE TOOL CO., Sidney, Ohio, announces that its engineering staff in Dayton, Ohio, has moved to new quarters at 346 Leo St.

ONLY DUAL-WEDG* LOCK gives you all these advantages



- FASTER—MORE ACCURATE SET-UP—IT'S FOOLPROOF!
- NO WEAR ON CUTTER BODY—(Unlimited Body Life)
- UP TO 25% MORE EXPANSION
- SELF-SEATING ADJUSTMENT AXIALLY AND RADIALLY
- GREATEST POSSIBLE AREA OF HOLDING CONTACT
- LOWER REPLACEMENT COST AND EASY REPLACEMENT (Tool Body Recess Never Requires Resizing)





SIMPLIFIES LOCKING

The Wesson Dual-Wedg Lock is a compact unit consisting of only four parts. It combines the principles of a turnbuckle and opposed wedges. The action of the Lock is controlled by a single Allen-type lead screw. Turning this screw moves the two wedges in opposite directions to either firmly lock or unlock the assembly. The complete Dual-Wedg Lock is cylindrical in shape with one flat side. To use the Dual-Wedg Lock the body in which the insert is to be locked is therefore simply drilled to accommodate the Lock.

WIDE APPLICATION RANGE

The inherent simplicity in design and application of the Wesson Dual-Wedg Lock offers many advantages for a great variety of applications including tool bits, milling cutter blades, broaching inserts, end mills, sheaves, boring head inserts, etc.

Available from stock in a complete range of sizes.

For complete information on how the Wesson Dual-Wedg Lock operates, how it is applied, plus standard sizes available from stock, write today for Bulletin 1-54-10.

WESSON COMPANY
1220 WOODWARD HEIGHTS BOULEVARD
FERNDALE (DETROIT 20) MICHIGAN

*trademark

Pennsylvania

J. D. WARFIELD has been named assistant manager of the gearing division by the Westinghouse Electric Corporation, Pittsburgh, Pa. He will also act as vice-president and general manager of the Schneider Mfg. Co., Muncie, Ind., recently purchased by Westinghouse. This plant produces torque converters for industrial machinery. Mr. Warfield was formerly assistant to the vice-president, apparatus products.

JOHN D. WILSON has been named manager of the Sel-Lok Spring Pin Division of the Standard Pressed Steel Co., Jenkintown, Pa. Mr. Wilson, who was chief clerk in the Automatics Division, will now be responsible for engineering, production scheduling, and sales of the self-locking, spring-pin fasteners. This Division was set up last year when the company bought the Self Lock Fastener Corporation.

JAMES P. HAIGHT has been named to the newly created post of chief engineer by the Aluminum Company of America, Pittsburgh, Pa. Mr. Haight was formerly general manager of the fabricating division, the position which JOHN L. PATTERSON will now assume. Both men have served in engineering and operating capacities at Alcoa for thirty-five years.

J. RAY MCDOWELL and W. F. W. REEVE were recently appointed field engineers by the Hunter Spring Co., Lansdale, Pa. Mr. McDowell will be responsible for New York State, while Mr. Reeve will provide engineering services in Ohio and Kentucky.

WILLIAM D. TURNBULL, general sales manager of Kennametal, Inc., Latrobe, Pa., was recently promoted to the position of vice-president in charge of sales. In this capacity, Mr. Turnbull will coordinate all the sales activities of the company.

William D. Turnbull, who becomes vice-president in charge of sales for Kennametal, Inc.

TURBO MACHINE CO., Lansdale, Pa., has acquired the TABOR MFG. CO., maker of foundry molding machines and equipment, which will now be known as the TABOR MFG. DIVISION. The Tabor line will now be made at Lansdale.

JONES & LAUGHLIN STEEL CORPORATION, Pittsburgh, Pa., has begun operations at its new warehouse and container plant at Lancaster, Pa. The warehouse will serve eastern Pennsylvania, Delaware, Maryland, and West Virginia.

LOUIS DE MARCO was recently named vice-president in charge of sales and engineering for Firth-Loach Metals, Inc., McKeesport, Pa. JAMES E. GRAY was made sales manager.

FRANK KLIMA has been appointed manager of the newly acquired aluminum forging plant at Erie, Pa., of the Kaiser Aluminum & Chemical Corporation, Oakland, Calif.

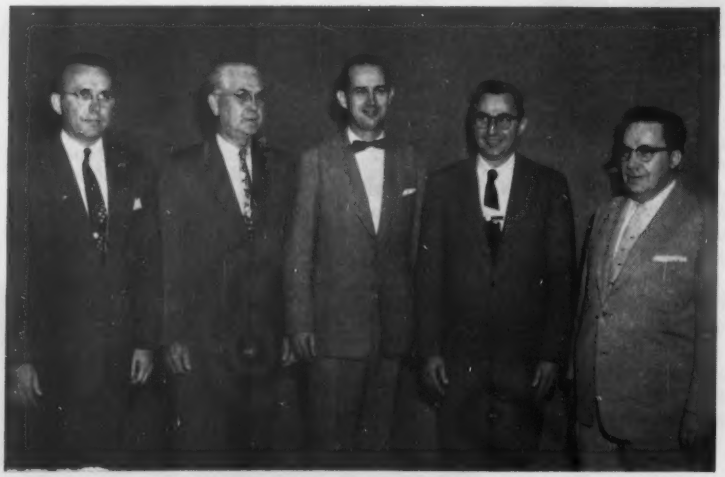
ENAMELSTRIP CORPORATION, Allentown, Pa., is constructing a $500,000 addition, the building site being adjacent to its present plant.

Wisconsin

MELVIN B. MONSON has been appointed manager of the Milwaukee, Wis., plant of Joseph T. Ryerson & Son, Inc., steel distributor, succeeding FRED KURFESS, who has retired. Mr. Monson joined Ryerson in 1934 at Detroit. After several assignments he became assistant manager at Milwaukee in 1953. Mr. Kurfess, who was with the company for forty-two years, served as Milwaukee manager for the last ten years. At the beginning of this year, Ryerson opened its new and much larger plant at 320 S. 19th St., Milwaukee.

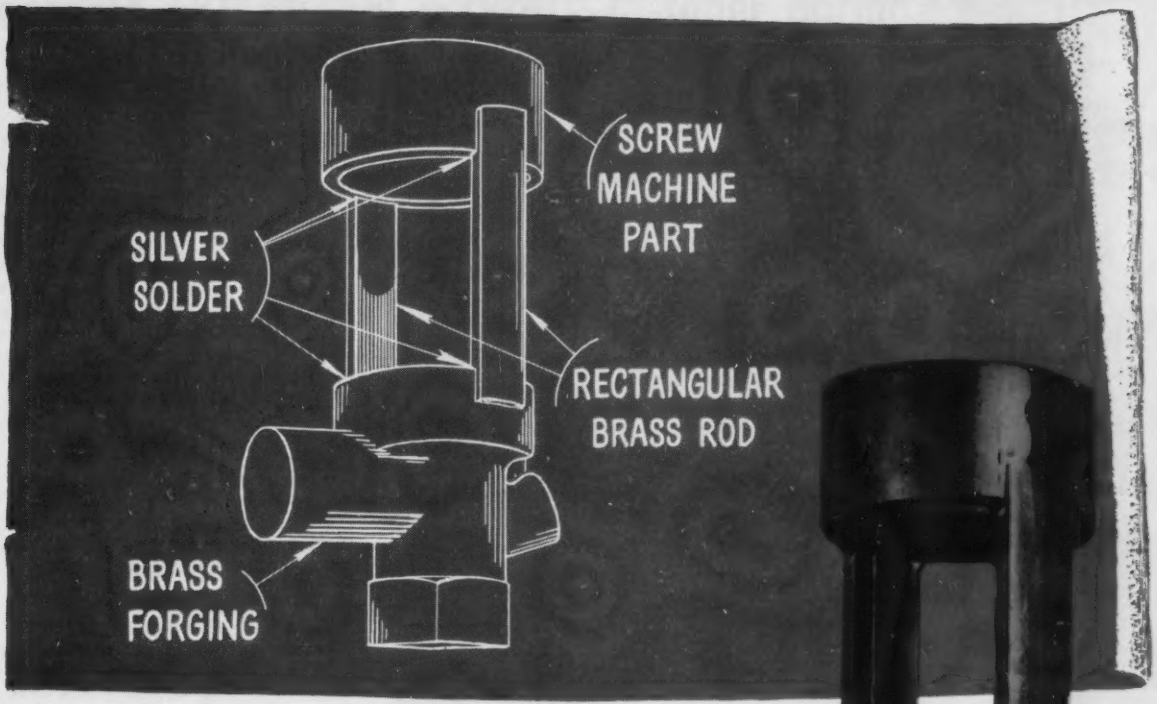
TWIN DISC CLUTCH CO., Racine, Wis., manufacturer of industrial friction and fluid drives, recently made the following appointments in its sales department: R. C. MCROBERTS, assistant sales manager, Hydraulic Division, Rockford, Ill.; J. B. SCHUBELER, manager, export sales; and E. H. BENNETT, district manager at Dallas, Tex. Mr. McRoberts was formerly a service engineer in the Hydraulic Division, while Mr. Bennett was district manager at Newark, N. J. The latter replaces H. A. DAVIS, who has resigned.

MILWAUKEE HAY TOOL CO., Milwaukee, Wis., announces the change



New officers of National Tool & Die Manufacturers Association are, from left to right, treasurer (re-elected), Philip R. Marsilius, vice-president of the Producto Machine Co., Bridgeport, Conn.; first vice-president, Joseph N. Huser, president of B & H Specialty Co., Inc., Indianapolis, Ind.; president, Jerome H. Stanek, vice-president of Stanek Tool & Mfg. Co., Milwaukee, Wis.; second vice-president, Herbert Harig, vice-president of Harig Mfg. Corporation, Chicago, Ill.; and secretary, Harold G. Murdock, vice-president of Arrowsmith Tool & Die Corporation, Los Angeles, Calif.

REVERE Brass Forging



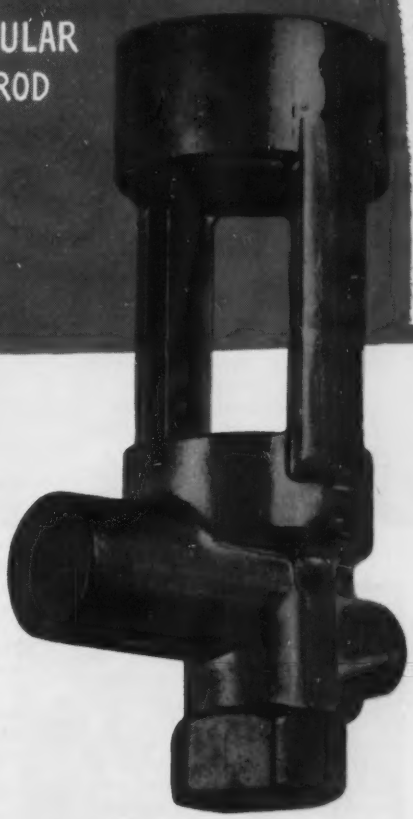
MAKES 1 PART OUT OF FOUR

. . . saves money

The one-piece brass forging shown here replaces a built-up part, formerly made of a screw-machine part, a forging, and two rectangular bars, assembled by four silver-soldered joints. The latter in turn replaced an iron casting, which was more expensive than expected, due to rejects. The part goes into a visible force-feed lubricator, which can operate at several thousand psi., and can be controlled to feed just a drop at just the right time to such equipment as compressors.

We suggest you look into forgings of copper, brass, other copper alloys, aluminum alloys. The forging process produces parts that are dense, non-porous, have many design details accurately and smoothly executed, require a minimum of machining. Revere knows a great deal about the forging of non-ferrous metals. In the case shown here, we collaborated closely with the customer in designing the part so it could be forged in one piece instead of being assembled out of four different items. The result is a better part, and appreciable economies.

For information about forgings, see the nearest Revere Sales Office.



Partially-machined brass forging for sight feed of force-feed lubricator.

At top, drawing showing how this part formerly was assembled out of four different pieces.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N.Y.

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.

SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

For more information on products advertised, use Inquiry Card, page 245

of name to the MILWAUKEE TOOL & EQUIPMENT CO., INC. Besides manufacturing hay unloading tools, the company has expanded its manufacturing facilities to include hardware vises and railroad car hand brakes.

RELIANCE ELECTRIC & ENGINEERING CO., Cleveland, Ohio, is opening a factory sales office in Milwaukee, Wis., located at 5856 N. Port Washington Road. VERNON S. BARNES has been made branch manager there.

HARNISCHFEGER CORPORATION, Milwaukee, Wis., recently opened a district office for its Welding Division at 1821 N.B.C. Bldg., 815 Superior Ave., N. E., Cleveland, Ohio. A. T. MORTRUD is district manager.

LYMAN K. SHEPARD has been named sales manager of the Wisconsin Drill Head Co., Butler, Wis.

* * *

Correction

In November MACHINERY, page 280, it was announced that STANLEY BERG & Co., Frick Bldg., Pittsburgh, Pa., was appointed a representative of the ERIE FOUNDRY Co., Erie, Pa., in the Pittsburgh area. Actually, Stanley Berg & Co. will represent Erie in the sale of its forge shop machinery line. NASH-PITTSBURGH CO., also located in the Frick Bldg., represents Erie in the Pittsburgh area in the sale of its Hydraulic Press Division products.

* * *

Motion Picture Reviews

DIE-CASTING

"Die Casting—How Else Would You Make It?" is the title of a 16-millimeter color and sound motion picture now available through the American Zinc Institute, Inc., 60 E. 42nd St., New York 17, N. Y. This film, which has a running time of thirty-five minutes, tells how designers are able to effect cost reductions and improve products by taking advantage of the die-casting process. An important section of the film is devoted to the evaluation of such die-casting alloys as zinc, aluminum, magnesium, and copper-base.

THREAD-CUTTING

A 16-millimeter color and sound motion picture film, produced by the Jones & Lamson Machine Co., Springfield, Vt., deals with the subject of thread-cutting. Beginning with the basic definition of a screw thread, the movie portrays both tangential and radial threading. The film is available on a loan basis.

New Books and Publications

DIMENSIONS AND TOLERANCES FOR MASS PRODUCTION. By Earle Buckingham. 164 pages, 8 1/2 by 11 inches; 179 illustrations. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N. Y. Price, $8.

In this book, the author proposes improved methods and practices to meet the problem of dimensioning with tolerances, and discusses their relation to production design, tool design, gage design, production, and inspection. In analyzing the uncertainties in present-day practice, he points out that the actual method of expressing dimensional information is of secondary importance. What is important is the recognition that several kinds of dimensions are needed on component drawings, and that several types of conditions must be definitely controlled by tolerances. In brief, the thesis is that all limiting conditions must be controlled by definite inspection procedures and it must be possible to translate every limiting dimension into a definite design and size of an inspection gage.

The treatise tells how limiting dimensions on detail drawings control conditions of bulk or size, conditions of form, conditions of position, and conditions of assembly, operation, or functioning. Also, it shows how the method used to specify permissible tolerances may need to be different for each of these conditions. Two chapters, each devoted to a specific product, illustrate step by step how the methods developed in the book are applied in controlling limiting conditions by the use of various types of dimensional and functional inspection gages.

Parts of this book were originally featured as an extensive series of articles in MACHINERY. Publication in book form affords the author an opportunity to present a more complete picture of the problem of dimensioning with tolerances.

Chapter headings are as follows: Need for an Adequate System for Dimensioning with Tolerances; Production Design; Dimensions and Tolerances for the Detail Drawing; Tolerances on Conditions of Size; Tolerances on Conditions of Form—Profiles; Tolerances on Conditions of Form—Tapers and Angles; Tolerances on Conditions of Position; Specification by Means of Functional Gages; Specifying Surface Finish; Production Design of 3-Jaw Chuck (illustrative example); Production Design of a 3/4-Inch Globe Valve (illustrative example); Summary; and Appendix—Definitions of Terms.

One major purpose of the book is to stir up a wide interest in dimensioning needs and lead to the development of improved methods. The 179 illustrations are of definite value in creating an understanding of the principles involved.

MACHINE SHOP OPERATIONS AND SETUPS. By Harold W. Porter, Charles H. Lawshe, and Orville D. Lascoe. 397 pages, 5 5/8 by 8 1/2 inches. Published by the American Technical Society, 848 E. 58th St., Chicago 37, Ill. Price, $5.50.

The authors, all on the staff of Purdue University, have designed this book to meet the specific requirements of modern instruction in machine shop techniques. Before writing the book, they made a survey of instructional practices and trends, and also developed a basic trade vocabulary by eliminating words that have become obsolete, or only in partial use. They then prepared this volume for the industrial learner in the machine shop field, carefully illustrating the material to aid in the understanding of important procedures.

Chapter headings are as follows: Machine Shop: Preparing for Opportunities; Measuring Tools: Semiprecision and Precision; Bench Tools, Including Layout and Power Saws; Drill Press: Construction, Types, Setups, and Operations; Engine Lathe: Setups and Operations; Shaper and Planer Setups and Operations; Milling Machine Construction, Cutting Tools, and Accessories; Milling Machine Setups and Operations; and Grinding Machines: Surface, Cylindrical, and Internal Grinding.

HOW TO USE AND CARE FOR MILLING CUTTERS. 56 pages, 8 1/2 by 11 inches. Published by the Milling Cutter Division of the Metal Cutting Tool Institute, 405 Lexington Ave., New York 17, N. Y. Price, (paper-bound), $1.

This publication endeavors to present, in pictures and non-technical language, the various factors that contribute to good milling practice. It also suggests means and methods of setting up, operating, and maintaining milling cutters so as to obtain the best possible results. In addition, there is a brief section on safety.

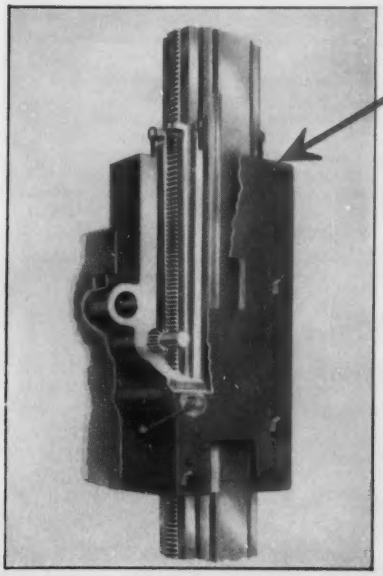
STANDARD METAL DIRECTORY (1954 Edition). 900 pages, 6 by 9 inches. Published by the Bardeen Press, Inc., 425 W. 25th St., New York 1, N. Y. Price, $15.

Now in the fourteenth edition, this directory contains more than 10,000 detailed reports on steel mills, foundries, smelters, rolling mills, and

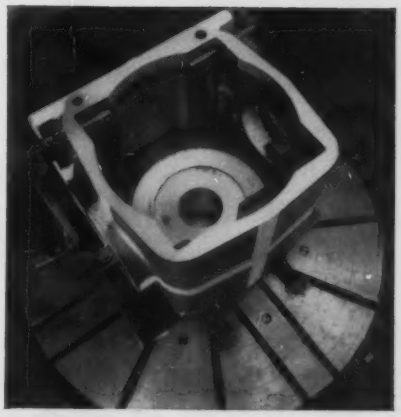
At The Oilgear Company — KING precision assures *exceptional accuracy* in taper boring

For the Oilgear Company, Milwaukee, Wisc., the 62″ King® Vertical Boring & Turning Machine, shown at right, precision-machines castings for high pressure pumps. An example of the extreme accuracy obtained is the taper boring, in Class 50 gray iron, of 7″ diameter x 8″ deep holes to .005″ per inch of taper, while holding .001″ tolerance on the diameter for the entire depth of the hole. A finish better than 125 micro-inches is maintained. On other boring, facing, and turning work—on parts for cases, end covers, rotors, etc., for 60, 100, and 150 hp. Oilgear Pumps—similar dimensional precision and fine finish are obtained.

Here again is on-the-job *proof* of how King superior design, massive proportions, and extra-rigid construction provide the ability to cut costs and improve quality on the complete range of boring, facing, and turning work. King machines are made in ten sizes, from 30″ to 144″. For full information see your King Distributor, or write us.



Cut-away drawing of rail head, at left, illustrates how extra rigidity is built into King machines, assuring an unvarying accuracy that makes possible fine-dimension tapering and other operations such as those described by the Oilgear Company . . . Drawing shows construction of support and guiding of the ram in its relation to the swivel. There are eight bearing surfaces, two on each side of the rectangular ram. Adjustment to these surfaces is obtained with the use of four gibs, two on the front and two on the side. To overcome any spreading of the guiding surfaces of the ram, a plate the full length of the swivel is tongued, as shown. Accurate guiding surfaces are thus maintained at all times.



Close-up view of the work being machined above. Note the fine finish (better than 125 micro-inches) obtained on the facing work and in the tapered bore, as a result of King built-in precision features.

KING AMERICAN STEEL FOUNDRIES • KING MACHINE TOOL DIVISION
1150 Tennessee Avenue . . . Cincinnati 29, Ohio
VERTICAL BORING & TURNING MACHINES

non-ferrous metal plants located in the United States and Canada. It is divided into four sections: iron and steel plants; ferrous and non-ferrous metal foundries; metal rolling mills; and smelters of non-ferrous metals. Two new features have been added: a list of distributors of non-ferrous metals throughout the United States and Canada; and a list of smelters and refiners of non-ferrous metals throughout Europe.

HOW TO USE AND MAINTAIN GEAR CUTTING TOOLS. 32 pages, 8 1/2 by 11 inches. Published by the Gear Generating Tools Sub-Division of the Metal Cutting Tool Institute, 405 Lexington Ave., New York 17, N. Y. Price, (paper-bound), $1.

This booklet is designed to help users get the most out of gear cutting tools. Six chapters deal with each basic type of tool in turn—hobs, shaper cutters, Shear-Speed cutting tools, gear shaving cutters, milling cutters for gears, and broaches for gears—starting with the process, covering such factors as proper mounting of tools and work-pieces, proper feeds and speeds, sharpening, inspection, and storage. A section on coolants and their applications is included. Reference tables give rules and formulas for spur gears—diametral pitch and circular pitch.

CONTRACT TERMINATION GUIDE. 59 pages, 8 1/2 by 11 inches. Published by the Manufacture Department, Chamber of Commerce of the United States, 1615 H St., N. W., Washington 6, D. C. Price (in pamphlet format), $1.

This pamphlet has been prepared by the Chamber of Commerce of the United States to interpret current settlement procedures in terminating government contracts, and to assist prime contractors, sub-contractors, and suppliers in the preparation and submission of claims.

A GERMAN-ENGLISH DICTIONARY OF AUTOMATIC CONTROL TERMS. 18-page paper, No. 54-IRD-4. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, 50 cents.

This paper consists of about 750 German words and their English equivalents in the automatic control field. It was compiled by D. W. Pessen, research engineer, Servomechanism Laboratory, of the Brown Instruments Division, Minneapolis-Honeywell Regulator Co.

Coming Events

NOVEMBER 29-DECEMBER 2—First INTERNATIONAL AUTOMATION EXPOSITION to be held at the 244th Regiment Armory, New York City. For further information, write to Exposition, 845 Ridge Ave., Pittsburgh 12, Pa.

DECEMBER 2-7—Twenty-first National Exposition of Power and Mechanical Engineering under the auspices of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS, at the Commercial Museum, Philadelphia, Pa. For further information write to: Manager, E. K. Stevens, 480 Lexington Ave., New York 17, N. Y.

MARCH 28-APRIL 1, 1955—Ninth Western Metal Exposition and Congress sponsored by the AMERICAN SOCIETY FOR METALS and nineteen other technical societies to be held at the Pan-Pacific Auditorium and the Ambassador Hotel, respectively, Los Angeles, Calif. A.S.M. secretary, William H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

APRIL 13-15, 1955—Tenth annual Meeting and Lubrication Exhibit of the AMERICAN SOCIETY OF LUBRICATION ENGINEERS at the Hotel Sherman, Chicago, Ill. Administrative secretary, William P. Youngclaus, Jr., 84 E. Randolph St., Chicago 1, Ill.

MAY 16-20, 1955—SIXTH NATIONAL MATERIALS HANDLING EXPOSITION at International Amphitheatre, Chicago, Ill. For further information, write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

SEPTEMBER 6-17, 1955—Machine Tool Show sponsored by the NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION to be held at the International Amphitheatre, Chicago, Ill. Further information can be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

SEPTEMBER 6-17, 1955—PRODUCTION ENGINEERING SHOW, coinciding with the Machine Tool Show, to be held at the Navy Pier, Chicago, Ill. For further information, write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (TITLE 39, UNITED STATES CODE, SECTION 233) SHOWING THE OWNERSHIP AND MANAGEMENT

of MACHINERY, published monthly at Bristol, Conn., for October 1, 1954.

1. The names and addresses of the publisher, editors, managing editor, and business managers are: Publisher, The Industrial Press, 148 Lafayette St., New York 13, N. Y.; Editor, Charles O. Herb; Consulting Editor, Franklin D. Jones; Business Managers, Robert B. Luchars, Edgar A. Becker, and Harold L. Gray. The address of all the foregoing is 148 Lafayette St., New York 13, N. Y.

2. The owners of 1 per cent or more of the total amount of stock are: The Industrial Press, Robert B. Luchars, Edgar A. Becker, Franklin D. Jones, Walter E. Robinson, Charles O. Herb, Harold L. Gray, Clifford Strock, and Suno E. Larson, all of 148 Lafayette St., New York 13, N. Y.; Helena E. Oberg, 65 Eighty-second St., Brooklyn 9, N. Y.; Edgar L. Becker Nominee for Nancy Jane Becker, Susan Louise Becker, and Donald Louis Becker, 370 Bedford Road, Ridgewood, N. J.; First National Bank of Montclair and Robert B. Luchars, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank of Montclair and Leigh Roy Urban, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank of Montclair and Kenneth D. Ketchum, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; Lee W. Noyes, Guardian for Susan Yarnall Urban, Greensboro, Vt.; Lee W. Noyes, Executrix of Will of Robert L. Urban, Greensboro, Vt.; and John T. Urban, 224 Sullivan St., New York 12, N. Y.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: Charlotte B. Baldwin, 420 Clinton Ave., Brooklyn, N. Y.; Robert B. Luchars, Franklin D. Jones, and Louis Pelletier, all of 148 Lafayette St., New York 13, N. Y.; Elizabeth Y. Urban, 38 Lakeview Road, Asheville, N. C.; Helen L. Ketchum, 231 King St., Cohasset, Mass.; Wilbert A. Mitchell, 28 Harlow Road, Springfield, Vt.; and Henry V. Oberg, 6825 Almansa St., Coral Gables, Fla.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

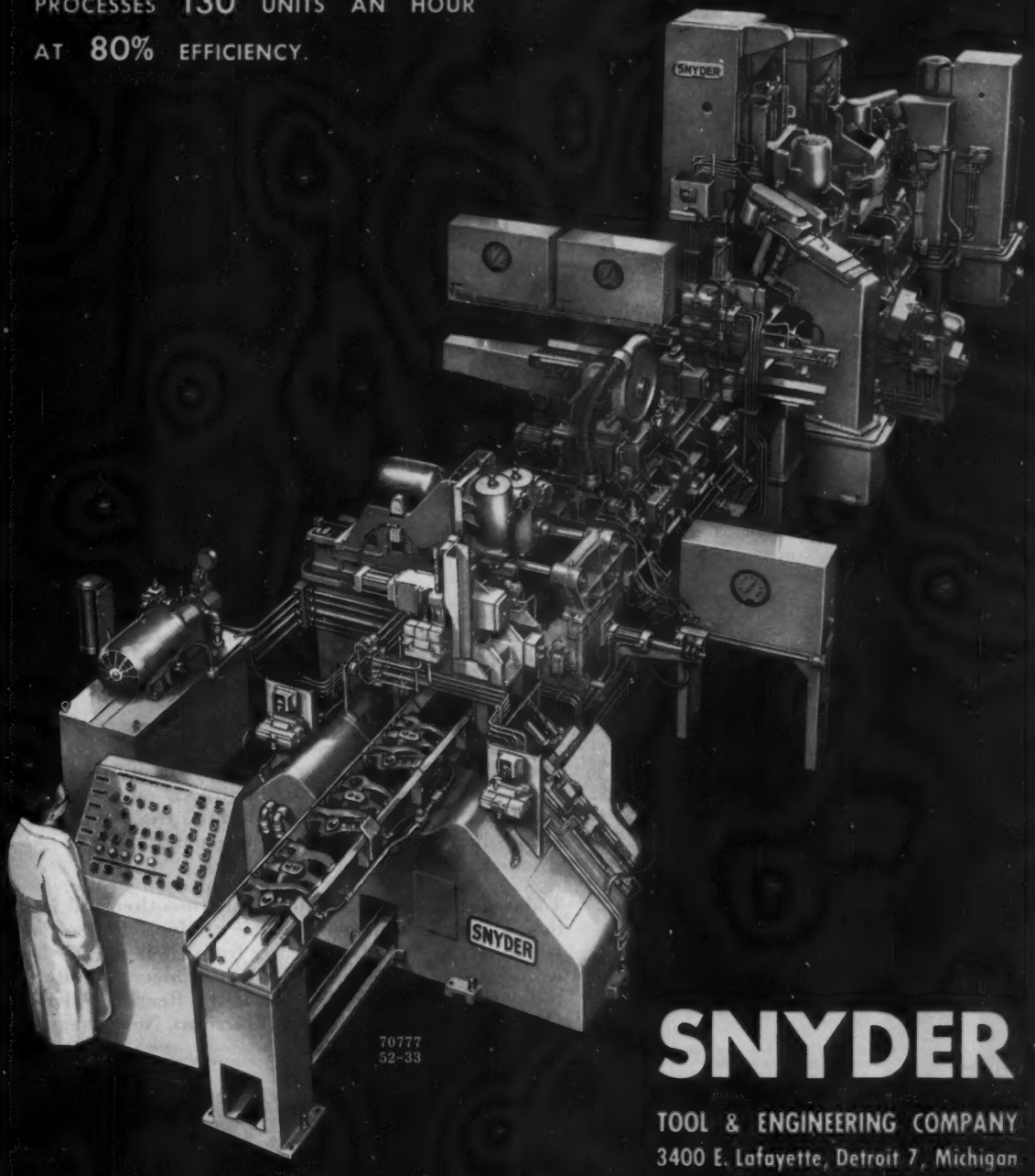
EDGAR A. BECKER, Business Manager

Sworn to and subscribed before me this 17th day of September, 1954. (SEAL)

ALEXANDER LOYKA
Notary Public, State of New York
No. 41-7611350
Qualified in Queens County
Commission Expires March 30, 1956

SNYDER SPECIAL 21-STATION AUTOMATIC LINE

TRANSFER MILLS, DRILLS, CORE-DRILLS, REAMS AND TAPS INTAKE MANIFOLDS; TESTS MANIFOLD FOR AIR LEAKAGE AND VOLUMETRIC AIR FLOW, INSPECTS PROCESSING PROGRESSIVELY, MARKS REJECTS; INSERTS HEATER TUBES; PROCESSES 130 UNITS AN HOUR AT 80% EFFICIENCY.

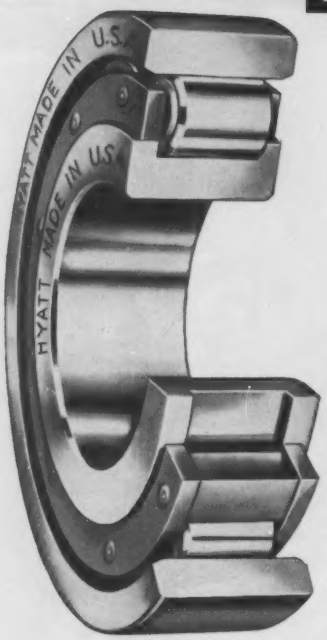


SNYDER

TOOL & ENGINEERING COMPANY
3400 E. Lafayette, Detroit 7, Michigan

29 Years of Successful Cooperation with Leading American Industries

ANOTHER VERSATILE HY-LOAD BEARING . . .

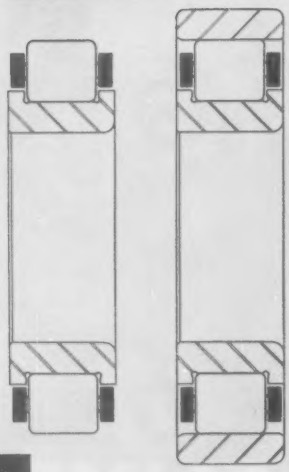


BU-Z

B indicates composite cage type—rollers spaced by conforming bars riveted to end rings

U indicates that the inner race has flanges at both ends to retain and align the rollers

Z indicates a separable straight cylindrical outer race



The Hyatt BU-Z Bearing is one of two basic Hy-Load types featuring a separable, interchangeable outer race, and is available in four series: 1200, 1300, 5200 and 5300.

Type BU-Z is designed for radial loads where the roller and inner race assembly must be kept with the shaft. The outer race may be omitted entirely, with rollers operating directly on the suitably hardened housing bore. This permits the use of larger-diameter shafts for greater rigidity—or smaller, more economical bearings.

Today thousands of products run smoother and last longer with less upkeep because of Hyatt Hy-Loads. If you're not already profiting from their use, contact your nearest Hyatt sales-engineer or write today for our Catalog No. 150. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

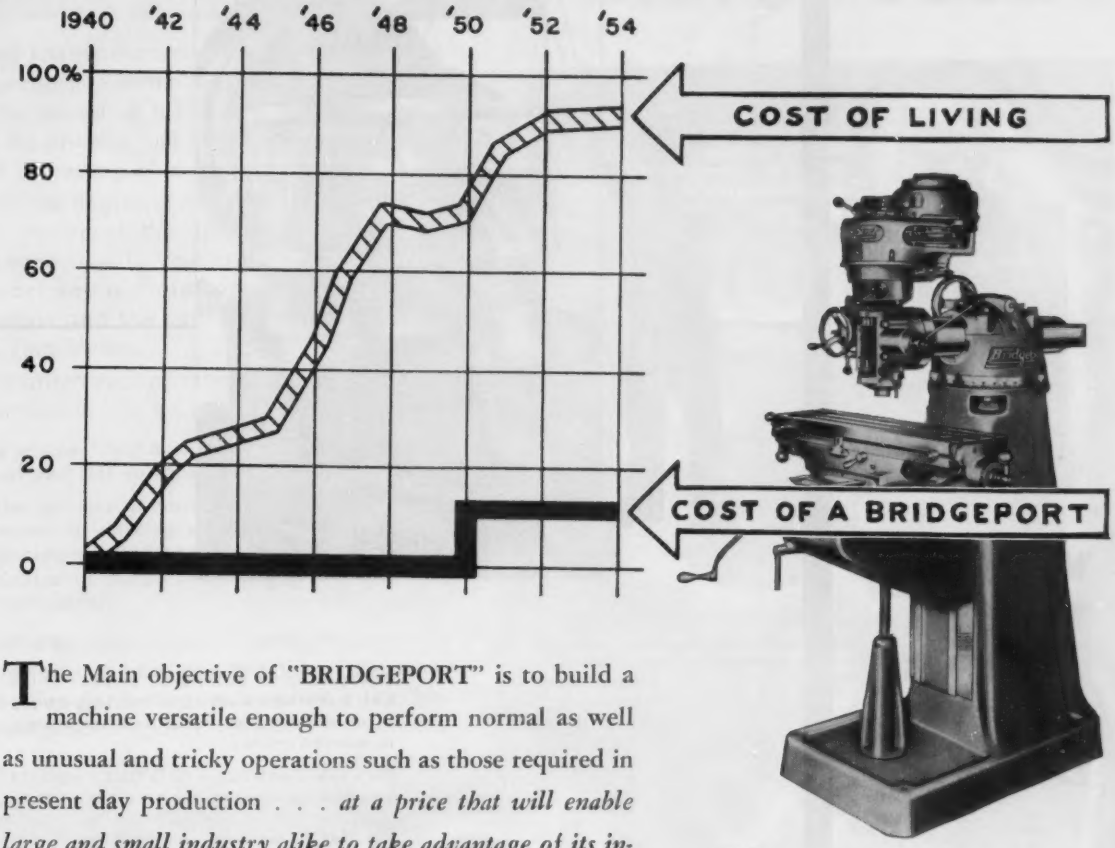
HYATT ROLLER BEARINGS

STRAIGHT BARREL TAPER

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, N. J.

For more information on products advertised, use Inquiry Card, page 245

Holding the Price Line!



The Main objective of "BRIDGEPORT" is to build a machine versatile enough to perform normal as well as unusual and tricky operations such as those required in present day production . . . *at a price that will enable large and small industry alike to take advantage of its inherent and exclusive advantages.*

With quality and accuracy a prime consideration and never sacrificed to achieve a low selling price, we believe you will be interested in what has been made possible through modern tooling and machinery plus a cooperative supervisory and labor force in holding the price line of "Bridgeport Millers" over the past 16 years. The chart reproduced here tells the story far better than words.

If prices of various commodities in every day use had increased no more than the price of the "BRIDGEPORT" . . .

You could buy the following today . . .

	. . . at these prices	. . . instead of these
Housing	$7850	$18,000
Automobile	913	2,046
Food	727	1,500
Apparel	280	500
Fuel, Electricity	224	300

Ask your dealer . . or us . . to show how by "holding the price line", shops both large and small have been able to modernize their production through the more than 20,000 "BRIDGEPORTS" shipped in the past 16 years.

Bridgeport MACHINES, INC.

Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

WHEN THE CHIPS ARE DOWN...

Every drop of cutting oil in your chips and turnings costs you money. Every drop adhering to the chips **after** drying, is **wasted** money.

De Laval Centrifugal Chip Oil Extractors salvage the maximum amount of oil. They speed up the salvaging process... operate free of gyration under normal loads ... are easy to load and unload... are built to take it.

De Laval not only makes Chip Oil Extractors in various types and sizes to meet each set of conditions, but De Laval Engineers are available to advise you on every phase of chip oil reclamation, including the handling of dried chips.

Put your chip salvage up to De Laval today — as many other metal working plants have already done.

DE LAVAL
centrifugal chip oil extractors

THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • **DE LAVAL PACIFIC CO.** 61 Beale St., San Francisco 5

For more information on products advertised, use Inquiry Card, page 245

How Much Automation for You?

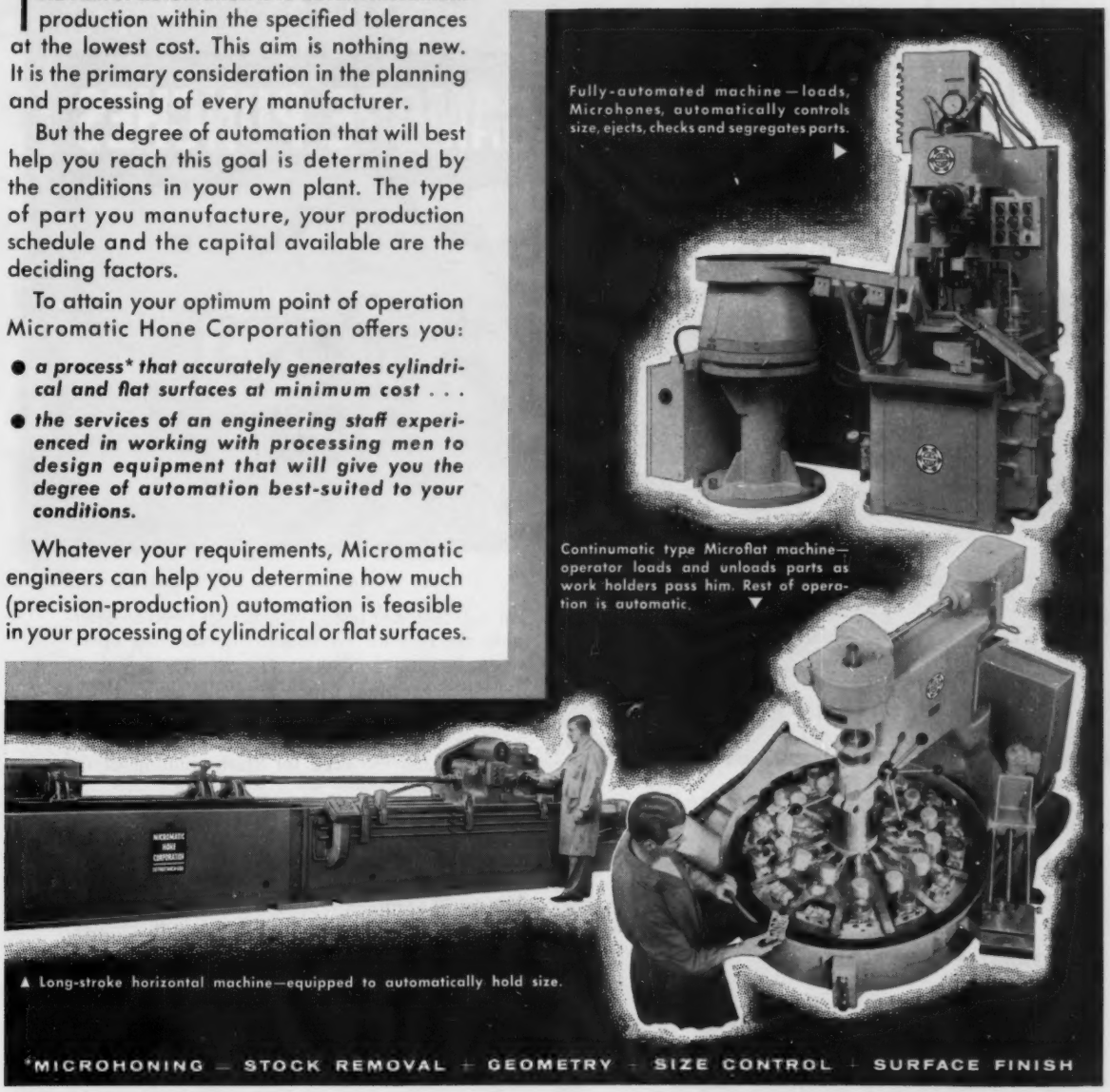
THE AIM of automation is to obtain maximum production within the specified tolerances at the lowest cost. This aim is nothing new. It is the primary consideration in the planning and processing of every manufacturer.

But the degree of automation that will best help you reach this goal is determined by the conditions in your own plant. The type of part you manufacture, your production schedule and the capital available are the deciding factors.

To attain your optimum point of operation Micromatic Hone Corporation offers you:

- ***a process* that accurately generates cylindrical and flat surfaces at minimum cost . . .***
- ***the services of an engineering staff experienced in working with processing men to design equipment that will give you the degree of automation best-suited to your conditions.***

Whatever your requirements, Micromatic engineers can help you determine how much (precision-production) automation is feasible in your processing of cylindrical or flat surfaces.



Fully-automated machine—loads, Microhones, automatically controls size, ejects, checks and segregates parts. ▶

Continumatic type Microflat machine—operator loads and unloads parts as work holders pass him. Rest of operation is automatic. ▼

▲ Long-stroke horizontal machine—equipped to automatically hold size.

*MICROHONING — STOCK REMOVAL + GEOMETRY + SIZE CONTROL + SURFACE FINISH

For more information write for general catalog and CROSS-HATCH Vol. 6

MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT AVE., DETROIT 38, MICHIGAN

1929 • 1954 — PRECISION PRODUCTION THROUGH MICROHONING — MICRO MATIC — 25TH YEAR OF DEVELOPMENT

MICROMATIC HONE CORP. MICRO-MOLD MFG. DIV. Boston Post Road Guilford, Connecticut

MICROMATIC HONE CORP 2205 Lee Street Evanston, Illinois

MICROMATIC HONE CORP. 1535 Grande Vista Avenue Los Angeles 23, California

MICROMATIC HONE LTD. 330 Grand River Avenue Brantford, Ontario, Canada

MICROMATIC HONE CORP MICRO-MOLD MFG. DIV. 231 So. Pendleton Avenue Pendleton, Indiana

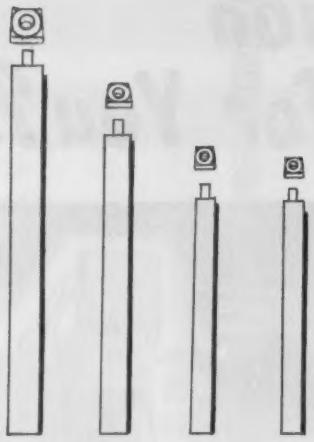
REPRESENTATIVES- Allied Northwest Machine Tool Corp., 103 S.W. Front Ave., Portland 4, Oregon • Mason Machine Tool Company, 415 So. Second East, Salt Lake City, Utah • Tidewater Supply Co., Charlotte 4, North Carolina Perine Machinery & Supply Co., 1921 First Ave., South, Seattle 4, Washington

REPRESENTATIVES IN ALL PRINCIPAL COUNTRIES

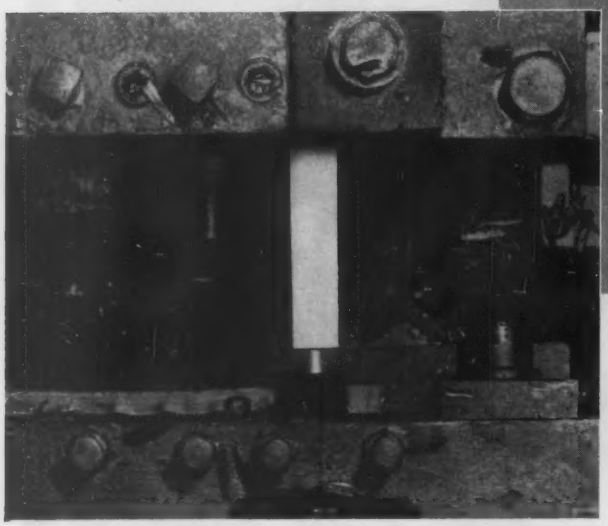
SUBSIDIARY.

Micro-Precision Inc., 2205 Lee Street, Evanston, Illinois

Hydraulic Controls • Diesel fuel injection equipment



A-L CUSTOMER FINDS SAGAMORE PUNCHES BEST IN TOOL-COST STUDY



Looking down on the SAGAMORE high speed cold nut punch in horizontal press.

An A-L customer tested various tool steels to determine the best for his varied cold-punching operations. New, air-hardening, non-deforming Ludlum Sagamore Die Steel was the ultimate choice. Here's why:

- The use of SAGAMORE cold-drawn stock eliminated the need for finish-grinding of the punches.
- Punches of SAGAMORE outperformed those of carbon-vanadium steel three to one.

The SAGAMORE punches were hardened by heating in a salt bath to 1750F. and air cooled. They were then given a double draw at 1110F. The resulting Rockwell hardness was 51C.

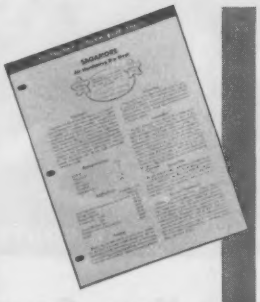
Characteristics of Ludlum SAGAMORE are: Excellent non-deforming properties, unusual toughness, lower hardening temperatures, and easier machining and grinding. These, plus the comparatively low cost, make it a good selection for this type of application.

For assistance with your tool or die steel problems, call your local A-L representative or distributor today, or write *Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.*

Write for your SAGAMORE BLUE SHEET

This four page report was compiled from data collected in laboratory and field tests. Included is complete information on applications, physical characteristics, forging, annealing, hardening, tempering, etc. *Ask for your copy.*

Address Dept. M-60



For complete **MODERN** Tooling, call

Allegheny Ludlum

WAD 5328

AL® FINE TOOL STEELS SINCE 1854

For more information on products advertised, use Inquiry Card, page 245

You asked for it... here it is

A SUPERIOR CARBIDE FOR STEEL MILLING

Now you can get what has been long needed . . . a sintered carbide produced specifically for steel milling cutter purposes, exhaustively tested and *proved* to be superior to any grade previously available.

The *new* FIRTHITE TXL definitely increases the volume of metal removed in mass production operations, materially reduces unit costs—through uniform performance from remarkable strength with higher wear and crater resistance.

FIRTHITE TXL is not just a new grade designation for a "hopped up" existing grade. It is a completely new combination of materials and processes painstakingly worked out in Firth Sterling research laboratories and pilot plants to do *one job better than it has ever been done before.*

How well it succeeds is shown in the results of carefully controlled field tests at right.

Write for technical bulletin and prices today.

TESTED AND PROVED SUPERIOR

Firthite TXL, through exhaustive tests in both Firth Sterling laboratories and in the field, has given superior performance. In a recent test by a prominent Midwestern milling cutter manufacturer, Firthite TXL, against ten competitive grades, proved superior in all cases and showed from 25% to 55% less wear at 5 cuts and 23% less wear at 20 cuts. Six grades were worn beyond repair before the test was completed.

The test was conducted under severe breakdown conditions on a 10" milling machine using a 6" R.H. cutter with one tooth . . . 1" square with ½ corner radius. The material used was SAE 1020 normalized forged bar steel which was climb milled at 1375 S.F.P.M. with 4⅝ inches per minute feed resulting in approximately .0053" chip load. Depth of cut was .050" and overhang of work was 3".

Firth Sterling

—INC—

GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

OFFICES AND WAREHOUSES*: BIRMINGHAM CHICAGO* CLEVELAND DAYTON DETROIT* HARTFORD* HOUSTON LOS ANGELES* NEW YORK PHILADELPHIA PITTSBURGH WASHINGTON WESTFIELD, N.J.

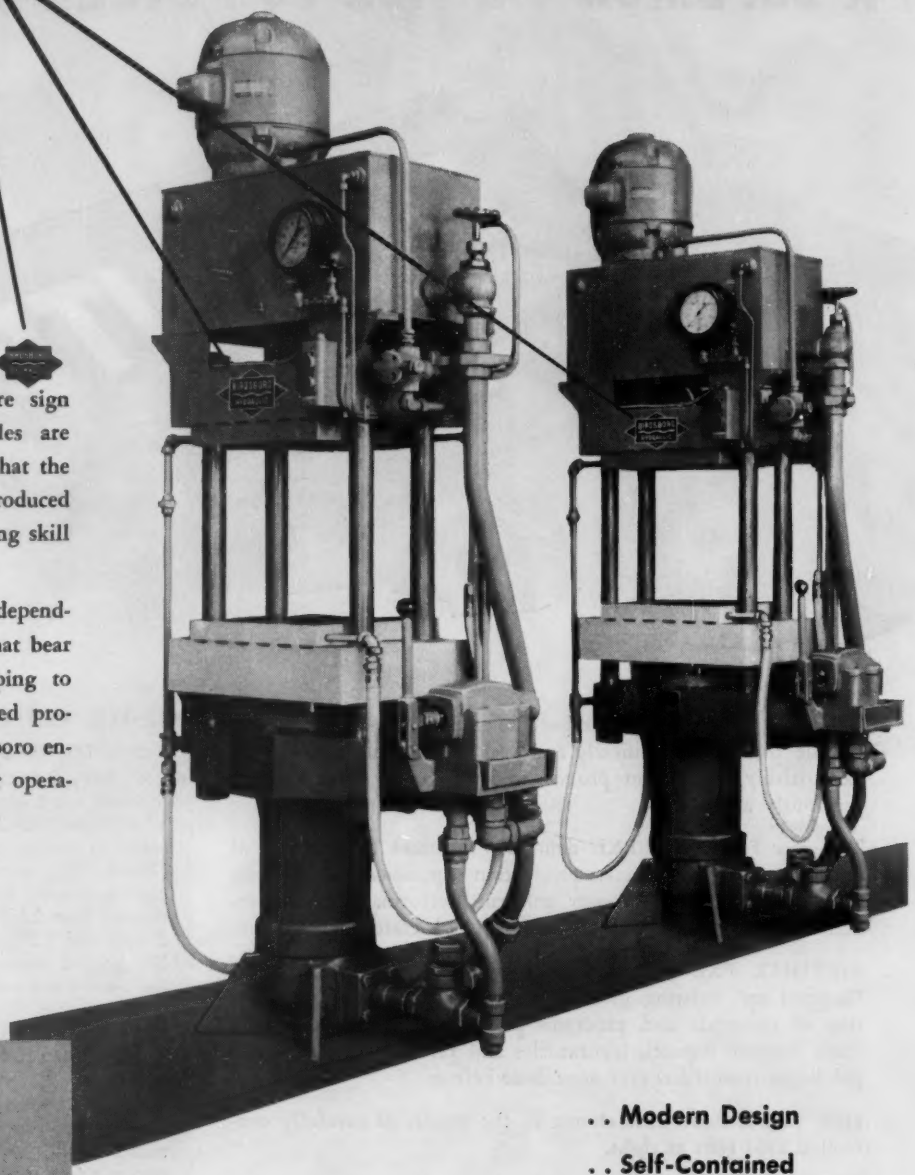
R-300

PRODUCTS OF FIRTH STERLING METALLURGY

High Speed Steels
Tool & Die Steels
Stainless Specialties
High Temperature Alloys
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature-Cermets
Zirconium

For more information on products advertised, use Inquiry Card, page 245

SURE SIGN of Fast, Efficient Production



Wherever you see it, this trademark is a sure sign that production schedules are right on the nose . . . that the precision parts being produced are as good as engineering skill can make them.

In plants everywhere, dependable hydraulic presses that bear this trademark are helping to raise efficiency and speed production. See what Birdsboro engineers can do for your operation today.

These two 50-ton molding presses are molding parts for North American Aviation Co.

. . Modern Design

. . Self-Contained

. . Scientifically Engineered

Designers and Builders of:

STEEL MILL MACHINERY
HYDRAULIC PRESSES
CRUSHING MACHINERY
SPECIAL MACHINERY
STEEL CASTINGS
Weldments "CAST-WELD" Design
ROLLS: Steel, Alloy Iron, Alloy Steel

HP-17-54

BIRDSBORO

BIRDSBORO STEEL FOUNDRY & MACHINE CO., BIRDSBORO, PENNA. Offices in Birdsboro, Pa. and Pittsburgh, Pa.

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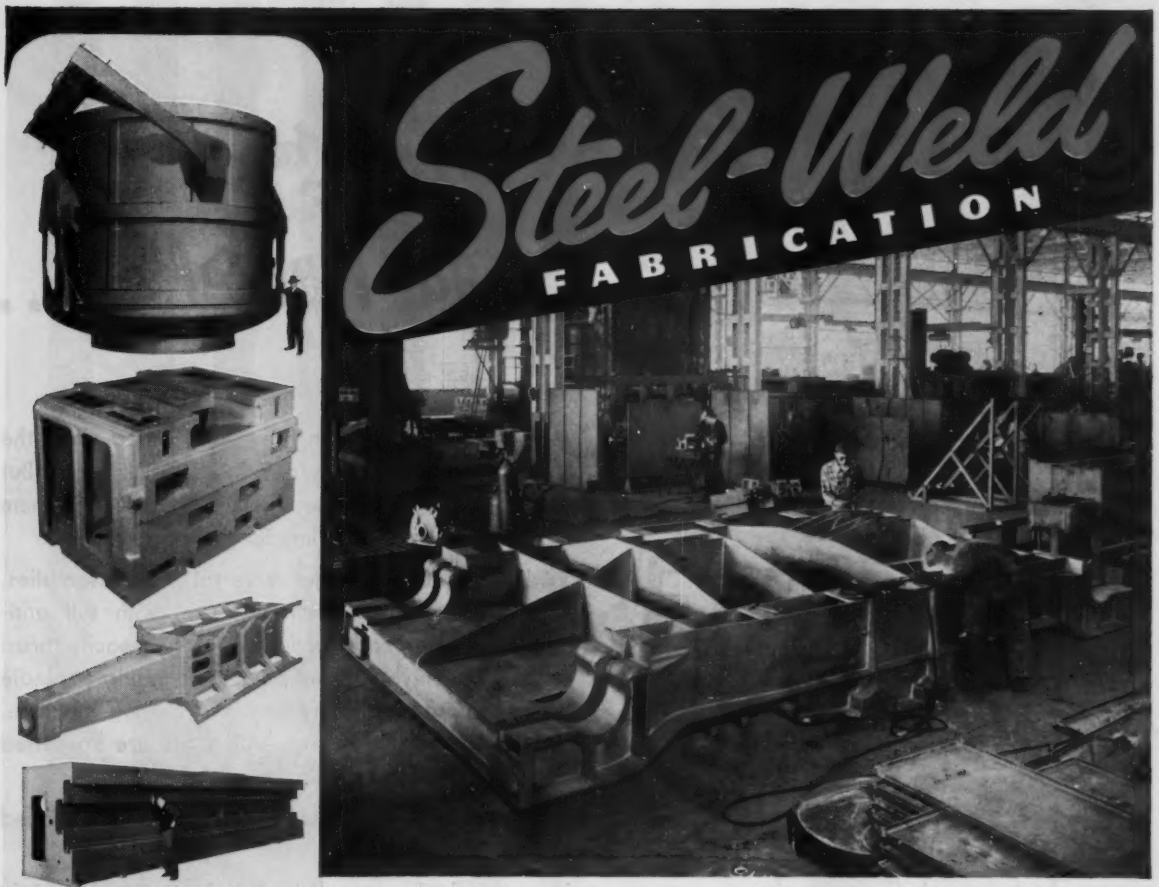
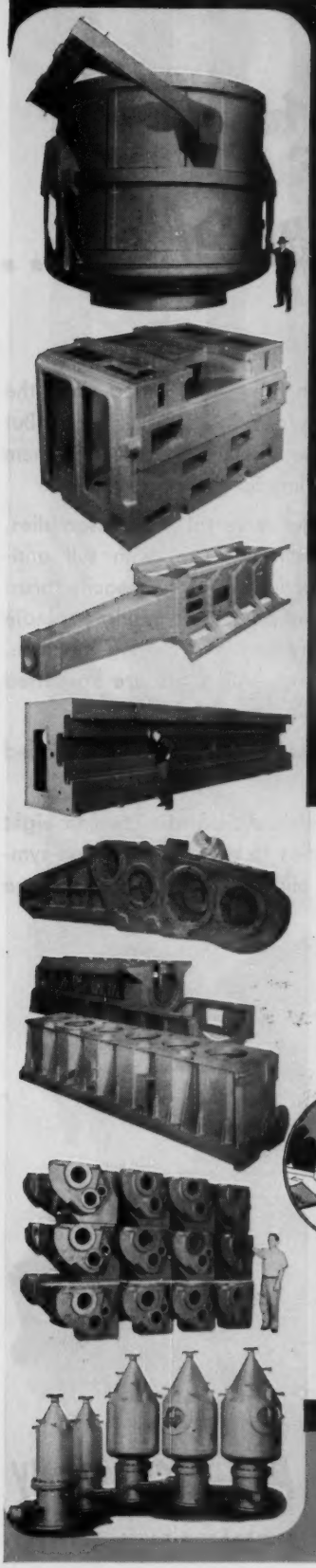




Use WELDED STEEL for Greater Strength with Less Weight!

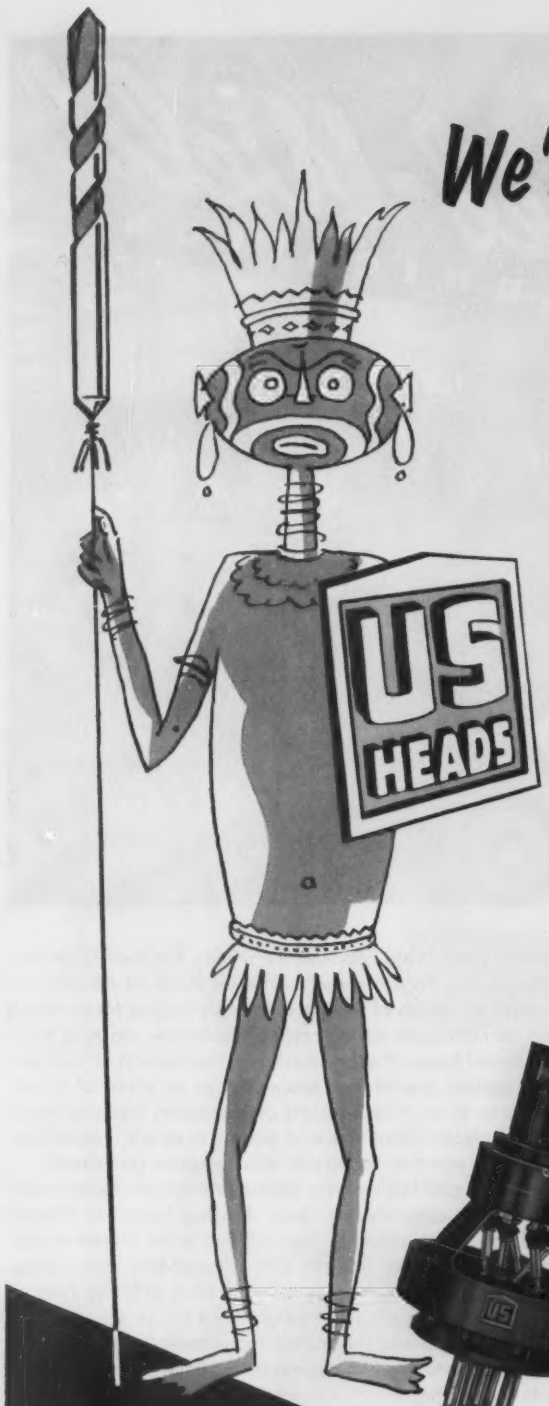
Heavy Steel-Weld Fabricated parts like the piece illustrated above, and the parts and assemblies shown at the left, are typical examples of work produced by Mahon for hundreds of manufacturers of processing machinery, machine tools, and other types of heavy mechanical equipment. If you need a complete special mechanical device or piece of equipment, or if you require parts or assemblies involving large heavy pieces where time and pattern costs are a consideration, you can turn to Mahon with complete confidence . . . personnel and facilities are available within the Mahon plant to do the complete job from drawing board to finished machining and assembly. You will find in the Mahon organization a unique source with ultramodern fabricating, machining and handling facilities to cope with any type of work regardless of size or weight . . . a source where design skill and advanced fabricating technique are supplemented by craftsmanship which assures a smoother, finer appearing job embodying every advantage of Steel-Weld Fabrication. See Mahon's Insert in Sweet's Product Design File, or have a Mahon engineer give you complete information.

THE R. C. MAHON COMPANY
DETROIT 34, MICHIGAN

Engineers and Fabricators of Steel in Any Form for Any Purpose

MAHON

We're Looking for Head Hunters!....



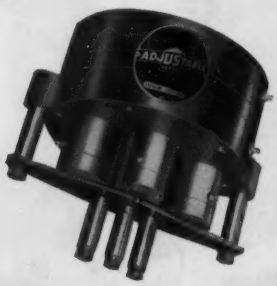
Most machine tool men have long relied upon the "US" Adjustable Multiple Spindle Drill Heads. But we are looking for those who still haven't tried them . . . and who are looking for the best.

With their quick-change universal joint assemblies, they are built for continuous use, with full anti-friction bearing construction for high capacity thrust loads. The universal joint adjustable multiple spindle type is suitable for any sensitive drilling machine. Joints are self-lubricating. All gears are hardened and shaved with spindles superfinished.

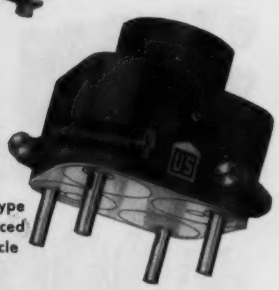
The single eccentric type is used for equally spaced holes on bolt circles.

The new double eccentric AdjUStafix, two to eight spindles, permits spindles to be located in non-symmetrical patterns. It eliminates expensive change in set-up.

Universal joint with slip spindle fixed locating plate



Double eccentric type for irregular spacing



Single eccentric type for equally spaced holes on bolt circle

Write for details on any type of universal joint adjustable head. Ask also about our totally enclosed gear-driven adjustable, fixed center, or individual lead screw tapping heads.

UNITED STATES DRILL HEAD COMPANY

616-618 BURNS STREET • CINCINNATI 4, OHIO

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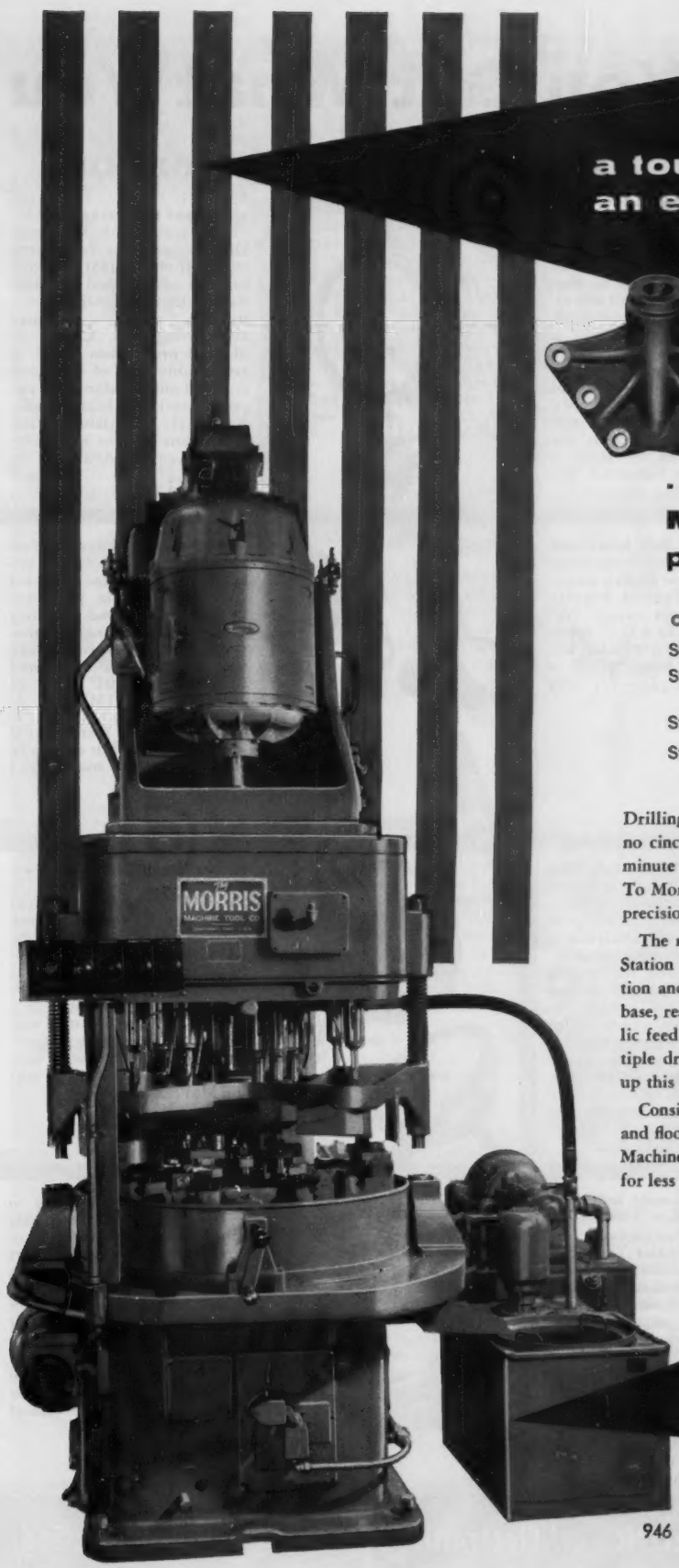


a tough job... an easy solution

...another MORRIS MOR-SPEED production machine

OPERATIONAL CYCLE:

Station	1	Load and Unload
Station	2	Drill two 57/64″ holes Drill four 29/32″ holes
Station	3	Spot face six holes
Station	4	Ream (.9062″) two holes

Drilling six large holes in armor plate forgings is no cinch, but when you want a finished part every minute and twenty seconds, that's a tough problem. To Morris Engineers, it was a familiar problem... precision drilling on a mass production basis!

The machine furnished was a MOR-SPEED Four Station Vertical, giving "special machine" production and precision at remarkably low cost. Standard base, rear column, indexing table, slide and hydraulic feed mechanism are combined with special multiple drilling head and work fixtures . . . to make up this high production machine.

Consider the savings . . . investment, labor, time and floor space . . . offered by Morris MOR-SPEED Machines. Precision high production can be yours for less than you might imagine!

Ask your Morris representative for details on our deferred payment plan.

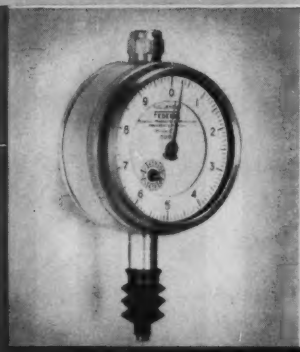
Morris

946 HARRIET STREET CINCINNATI 3, OHIO

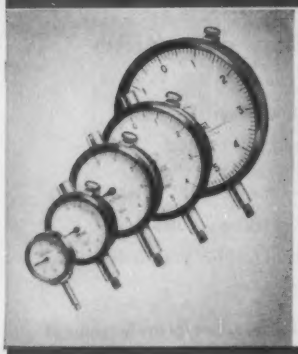
FEDERAL You Get What You

That's Only One Reason*

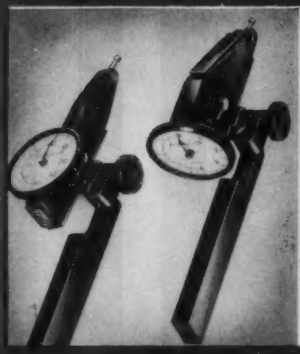
Basic Design Still Unsurpassed — Basically the same today as when first invented 37 years ago, the Federal Dial Indicator movement continues to outperform and outsell all others. The low friction movement, first introduced by Federal, is supported between massive plates; surpasses all later attempted innovations. Federal Dial Indicators are immediately sensitive, for inertia and friction are reduced to the minimum. Even the hand is dynamically balanced for greatest possible accuracy.



Wetproof Indicator — Completely sealed, this Wetproof Dial Indicator is fully protected from coolant, oil, oil fog and other liquid contaminants. Eliminates maintenance troubles under adverse operating conditions. Crystal is of glare-proof glass which is remarkably free of halations and will not discolor when exposed to oil or staining liquids. Regularly furnished with revolution counter and cushion movement. Available in "C" (2¼" O.D.) size and made to A.G.D. specifications.



Five Sizes to Suit Space and Visibility Requirements. Over Eighty Different Models Available — All Federal Regular Type Indicators except "A" Size, are made to A.G.D. specifications. The five sizes are respectively: A — 1¼", B — 1 11/16", C — 2¼", D — 2¾" and E — 3⅜" dia.



Testmasters — Universal Test Indicators — Federal's Testmasters are the most copied Test Indicators in both this country and abroad. But they surpass all attempts at imitation in *accuracy, durability* and *adaptability*. Graduated .001" and .0001" and in .0025MM and .01MM.

A **Non-Magnetic Testmaster** is a new item which is especially advantageous to use around magnetic chucks.

Graduations To Suit Tolerance — Dials in all Indicator sizes available graduated .00005", .00025", .0001", .0005", or .001", and Metric. Dials can be Balanced (plus and minus) Dials, graduated for regular tolerance comparison, or Continuous Reading (graduations numbered continuously) for direct measuring such as thickness, depth, etc. Continuous Reading Dials regularly furnished with Revolution Counter to facilitate reading total measurement. Special dials also furnished.

Perpendicular Indicators. Two Sizes, Seven Graduations — Specially adapted to fixtures where the movement of the contact point must be at right angles to the Dial. This Indicator is the first to use a crown gear movement to reduce friction to a minimum and is a smooth running, sensitive and very accurate instrument. Indicators of this type are available with Regular and Cushion Movements.

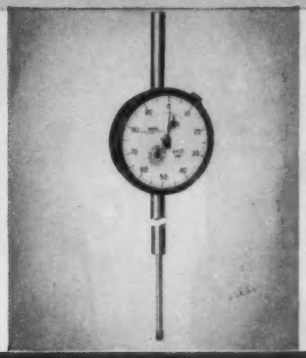
Cushion Movement Indicators — Federal offers a cushioned movement *optionally* on nearly all Regular Type Federal Dial Indicators. Many users prefer a directly geared movement where conditions require top accuracy. The Cushion Movement absorbs impact and prevents shock from reaching and damaging the small gear teeth, jewels, pivots and other parts. There is no increase in contact pressure or friction. Rigorous tests prove the exceptional stamina of this Movement.

Super-Sensitive Indicators — All Bushing Friction Eliminated — The movement is entirely enclosed — dust and dirt cannot enter. All jewels are the highest grade carefully polished sapphire. Contact travel is limited to a short range for greatest accuracy, yet is sufficient for the precise measurements required of the Indicator. It is designed for those who desire the utmost in accuracy.

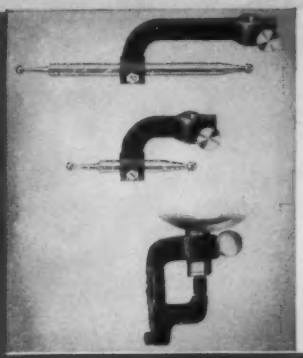
Dial Indicator, Air, Electric, or Electronic Gages — — for Inspecting,

Want From This Line

Why Federal Outsells All Others

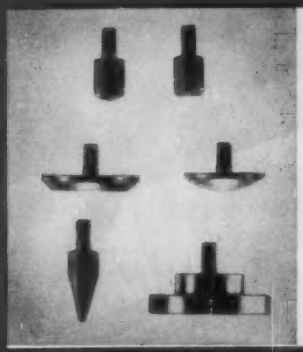


Long Range Indicators—These Federal Dial Indicators have longer ranges than the regular A.G.D. Models. They can be had in practically any length but those regularly provided have a range of .020" graduated .0001". And ranges of .100" and 2" graduated .001". All are 2¾" diam. or the regular "D" size Indicator. Revolution Counters are always furnished with Long Range Indicators to count off each revolution of the Indicator Hand.



Attachments — Hole Attachments facilitate testing internal and other surfaces inaccessible to the regular Indicator spindle. They fit Indicators with .275" or .375" stems. Right Angle Offset Attachment transfers motion at right angles to the Indicator spindle, directly to the Indicator. Arm is hinged by a flat spring, eliminating inaccuracies caused by wear or play in pivot-type bearings. This Attachment fits all Indicators with a .375" stem.

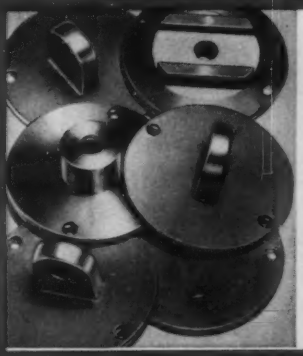
Long Stem Indicators—Recesses and similar places impossible to reach with regular Indicators are accessible to these Indicators. Stems of various lengths can be furnished to meet specific requirements. These Indicators are special and details of your requirements are needed with your order.



Contact Points — Federal Contact Points in any lengths varying by ⅛" are hardened steel and blackened to retard rusting. Several shapes and sizes are available. Wide Face Points of hardened and ground steel can be used when desired in place of Regular Contact Points. Special Points can also be furnished. Where Indicator Contacts are subject to excessive wear, Points can be furnished tipped with diamond, tungsten carbide, or hard chromium plate.

Lifting Lever — New, free acting. Does not affect the reading or accuracy of the Indicator and is furnished on regular bracket type back. Can be furnished to order on any other type of back. It can also be supplied separately assembled to a replacement back for use on existing "exposed" type Indicators.

Dust Guards — Keep out talc, dust, excessive oil, etc. Used on regular type points.



Backs — The Regular Type Back is standard with Federal Regular Type Indicators and is included in the price of the Indicator. Other Backs can also be furnished; with offset bracket, post bracket, screw bracket, adjustable bracket, and flat. Special Backs to meet customer's requirements can also be furnished to order.

Tolerance Hands — These Hands mark specified limits of any dimension. They can be set independently by rotating the knurled bezels and clamped in position. They do not interfere with setting Dial.

Weights — Compressible materials such as rubber, paper, textiles, etc., should be measured under constant pressure (not spring loaded). Federal provides weights, to conform with technical society standards. Pressure is directly through the rack spindle to the contact point.

Ask **FEDERAL** ***FOR ANYTHING IN DIMENSIONAL DIAL INDICATORS.*** — **If necessary, we could readily provide over a thousand combinations of our existing gears to make Federal Dial Indicators having every imaginable range and graduation. It's the most extensive line of Dimensional Dial Indicators in the world. Ask for your copy of the Federal catalog showing this most complete line.**

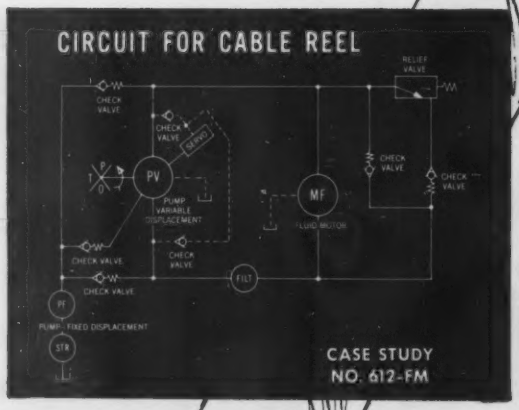
FEDERAL PRODUCTS CORPORATION

41112 Eddy Street • Providence 1, R. I.

*Watch for other reasons in later advertisements.

Measuring, Sorting, or Automatically Controlling Dimensions on Machines.

Shock loads can't hurt this fluid motor



Denison Axial Piston Fluid Motors recommended for the toughest jobs . . . without qualification

● Quick starts, quick stops, stalling under load, continuous braking. These are the kind of conditions Denison Fluid Motors are built for. Where other motors fail, Denison hydraulic motors operate continuously . . . in conveying equipment, mining, drilling, construction machinery.

Through efficient axial piston design, Denison hydraulic motors pack high horsepower, high torque in a smaller space. The 400 series fluid motor is less than a foot long, weighs only 40 pounds . . . yet delivers 24 horsepower.

Denison Fluid Motors can be furnished to develop up to 180 horsepower, 5665 pounds-inches torque . . . for any hydraulic circuit to 5000 psi.

The circuit shows a Denison Fluid Motor that reels cable in and out of oil wells. For bulletins about Denison Fluid Motors, write to: THE DENISON ENGINEERING COMPANY, 1244 Dublin Road, Columbus 16, Ohio.

PUMPS • MOTORS
CONTROLS • PRESSES

DENISON
TRADE MARK
Hydr**OIL**ics

For more information on products advertised, use Inquiry Card, page 245

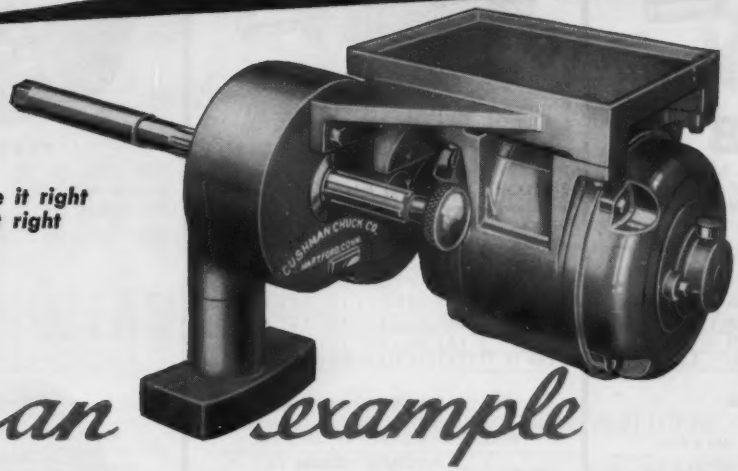
CUSHMAN

gives you CHUCK-ABILITY

CHUCK-ABILITY: — The ability to SPEED your work . . . ELIMINATE fatigue . . . IMPROVE your products . . . and REDUCE your costs . . . through design and selection of the right work-holding devices

Remember-

You can't machine it right unless you hold it right



an example

. . . is the Cushman Power Wrench, push-button controlled, for eliminating time-consuming, fatiguing, hand wrenching of chucks on single and multi-spindle machines, especially where repetitive machining operations are being performed.

Cushman Power Wrenches are available with either an 8 or 24 ft. lb. motor, delivering a maximum of 180 and 600 ft. lbs. torque respectively. By adding the Cushman Variable Torque Control, developed especially for use with the Power Wrench, the operator can, simply by setting a selector switch, predetermine any one of 9 stages of torque and inertia control.

With the Cushman Torque Control, Power Wrenches equipped with an 8 ft. stall-type motor will deliver from 45 to 180 ft. lbs. torque, and when using a 24 ft. lb. motor, torque can be varied from 150 to 600 ft. lbs. If greater or less driving force is required, the Cushman Engineering Department can design wrenches to suit your needs. Find out what Chuck-Ability can do for you. Write Cushman for Bulletin No. 211D fully describing and illustrating the Cushman Power Wrench — or, should you have a special work-holding problem, consult Cushman.

THE CUSHMAN CHUCK COMPANY

806 Windsor Street — Hartford 2, Connecticut, U.S.A.

CUSHMAN CHUCKMAN CHUCKS

Manufacturers of

Air Operated Chucks, Cylinders, and Accessory Equipment . . . The Cushman Power Wrench . . . Cushman Manually Operated Chucks and Face Plate Jaws.

Ask your Industrial Distributor

A WORLD STANDARD FOR PRECISION

6C854

THAT FINE LINE OF PERFECTION

There's a GEROTOR HYDRAULIC PUMP *to meet your requirements!*

The GEROTOR line of precision engineered hydraulic pumps is designed to fill the requirements of the majority of hydraulic equipment users. The three standard GEROTOR models cover a range of g.p.m. delivery from 4 g.p.m. to 40 g.p.m. Check the selection data for the pump to fill your needs.

TYPE QDB

Gerotor's NEW QDB series of small capacity pumps . . . the last word in precision engineering.

DELIVERY G.P.M. — 1800 R.P.M.					
TYPE	DISCHARGE PRESSURE P.S.I.				
	0	250	500	750	1000
QDB .4	.42	.40	.38	.35	.31
QDB .75	.84	.80	.78	.73	.66
QDB 1.5	1.67	1.62	1.57	1.50	1.42

Selection Data

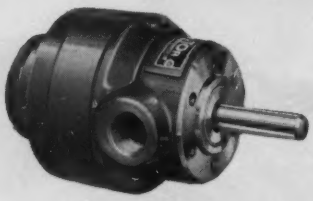
HORSEPOWER REQUIRED — 1800 R.P.M.					
TYPE	DISCHARGE PRESSURE P.S.I.				
	0	250	500	750	1000
QDB .4	.08	.16	.24	.33	.41
QDB .75	.13	.27	.41	.56	.71
QDB 1.5	.16	.42	.70	1.00	1.28

PRESSURE—Maximum continuous operating pressure is 1000 p.s.i.

SPEED—Standard design speed is 1800 r.p.m. Specific recommendations are made for applications at other speeds.

ROTATION—Standard rotation is clockwise facing shaft end. Counter-clockwise rotation is available.

OIL—Hydraulic oils with viscosity of approximately 300 s.s.u. at 100° F. are recommended.



TYPE QDH

The QDH . . . popular intermediate size of the Gerotor line

DELIVERY — G.P.M. AT 1200 R.P.M.							
TYPE	DISCHARGE PRESSURE P.S.I.						
	0	250	500	750	1000	1200	1500
QDH 3	3.3	3.2	3.1	3.0	2.9	2.7	2.5
QDH 5	5.6	5.4	5.3	5.2	5.1	4.8	4.4
QDH 8	8.6	8.5	8.4	8.3	8.2	8.1	7.8
QDH 12	12.9	12.8	12.7	12.5	12.3	12.2	11.8

Selection Data

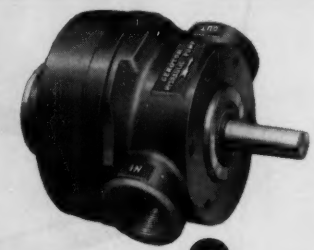
HORSEPOWER REQUIRED AT 1200 R.P.M.							
TYPE	DISCHARGE PRESSURE P.S.I.						
	0	250	500	750	1000	1200	1500
QDH 3	.25	.7	1.2	1.6	2.1	2.5	3.4
QDH 5	.33	1.1	1.8	2.5	3.2	3.7	4.6
QDH 8	.4	1.5	2.7	4.2	5.4	6.3	7.9
QDH 12	.5	2.3	4.2	6.1	8.0	9.6	11.7

PRESSURE—Maximum continuous operating pressure is 1200 p.s.i., maximum intermittent 1500 p.s.i.

SPEED—Standard design speed is 1200 r.p.m. Specific recommendations are made for applications at other speeds.

ROTATION—Standard rotation is clockwise facing shaft end. Counter-clockwise rotation is also available.

OIL—Hydraulic oils with viscosity of approximately 300 s.s.u. at 100° F. are recommended.



TYPE O

Gerotor Series O . . . when larger capacities are needed

DELIVERY — G.P.M. AT 1200 R.P.M.					
TYPE	DISCHARGE PRESSURE P.S.I.				
	0	250	500	750	1000
O-20	20.0	19.5	18.8	18.0	17.2
O-25	25.0	24.5	24.0	23.2	22.2
O-30	31.2	31.0	30.5	29.8	29.0
O-40	43.0	42.5	42.0	41.5	40.0

Selection Data

HORSEPOWER REQUIRED AT 1200 R.P.M.					
TYPE	DISCHARGE PRESSURE P.S.I.				
	0	250	500	750	1000
O-20	1.0	4.0	7.2	10.5	13.5
O-25	1.5	5.0	8.6	12.0	15.6
O-30	2.0	6.5	10.9	15.5	19.5
O-40	3.0	9.0	15.0	21.0	27.5

PRESSURE—Maximum continuous operating pressure is 1000 p.s.i., except type O-40, which is recommended for only intermittent duty at 1000 p.s.i.

SPEED—Standard design speed is 1200 r.p.m. Specific recommendations are made for applications at other speeds.

ROTATION—Standard rotation is clockwise facing shaft end. Counter-clockwise rotation is available.

OIL—Hydraulic oils with viscosity of approximately 300 s.s.u. at 100° F. are recommended.

Whatever your needs in hydraulic pumps . . . consult the GEROTOR engineers. Write for FREE literature and information, no obligation, of course.

GEROTOR MAY CORPORATION
P. O. Box 86—Baltimore 3, Maryland

GEROTOR

HYDRAULIC PUMPS — HYDRAULIC MOTORS

Pneumatic Bin Evacuators — Precision Contract Manufacturing

For more information on products advertised, use Inquiry Card, page 245

The Most Critical Parts in STANAT ROLLING MILLS--

--equipped with ORANGE Cage Type NEEDLE BEARINGS

"Roll Necks maintain precision under heavy load--never give trouble"

—reports Stanat Manufacturing Co., Long Island City, N. Y., after five years' experience with Orange Cage Type Needle Bearings in their strip and bar rolling mills and wire flattening mills, used in both the ferrous and non-ferrous metal-working industries. Eight Orange Bearings are used as back-up roll bearings in the roll necks of the Stanat 2-high/4-high Combination Mill shown.

Note that square-end rollers are held in alignment by pockets of a free-floating, land-riding cage made of anti-friction, non-ferrous metal. This cage merely guides—does not wear on rollers.

ORANGE Cage Design assures alignment of rollers—prevents skewing

By eliminating roller skewing, Orange Cage Type Needle Bearings add many advantages to the high load capacity and space savings of conventional needle bearings. For example:

Orange Cage Type Needle Bearings are true running in any position—on horizontal, vertical, tilted or overhung mountings. They are less affected by misaligned mountings or uneven loading. Internal clearances can be accurately controlled. They provide extremely smooth, quiet, trouble-free operation.

Stock sizes from ½" to 8" shaft dia., interchangeable with all standard heavy-duty needle bearings. Stocks and engineering service in all industrial areas.

Send for Engineering Data Book

ORANGE ROLLER BEARING CO., INC., 552 Main Street, Orange, N. J.

Product Directory

To find headings easily, look for capital letters at top of each page to denote locations.

ABRASIVE CLOTH, Paper and Belt
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVES
See Discs, Abrasive

ABRASIVES, HONING
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

ABRASIVES, Polishing, Tumbling, Etc.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
American Steel Foundries, Elmes Engineering Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.

CLUTCH KNOW-HOW
AT YOUR SERVICE
ROCKFORD CLUTCH engineers have designed clutches, power take-offs and speed reducers for hundreds of different products. This wide experience can help solve your power transmission control problems. Just send a description or print of your needs for their recommendations.
SEND FOR THIS HANDY BULLETIN
Shows unique ROCKFORD CLUTCH and POWER TAKE-OFF applications. Contains diagrams, dimensions, capacity tables, etc.
ROCKFORD CLUTCH DIVISION
Borg-Warner Corporation
410 Catherine Street, Rockford, Illinois
ROCKFORD CLUTCHES

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOY STEELS, High Temperature
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

ALLOYS, Non-Ferrous
American Brass Co., 25 Broadway, New York.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

ALLOYS, Zinc
New Jersey Zinc Co., 160 Front St., New York, N. Y.

ARBOR PRESSES
See Presses, Arbor

ARBORS AND MANDRELS
Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Keo Cutters, 19326 Woodward, Detroit, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.

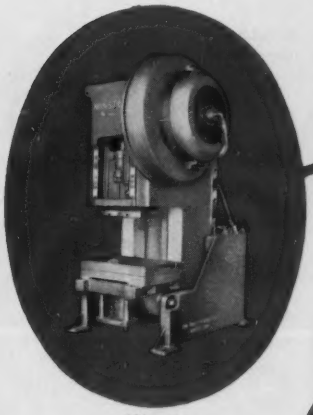
(*Continued on page 286*)

A Minster Press means

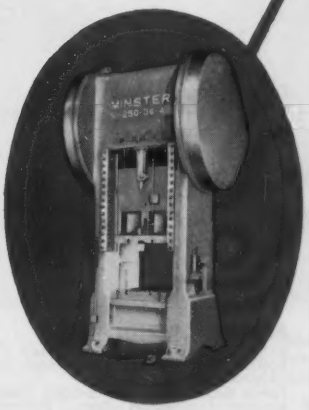
LESS SCRAP

BUY MINSTER AND BE SURE YOU GET THE RIGHT PRESS FOR THE JOB

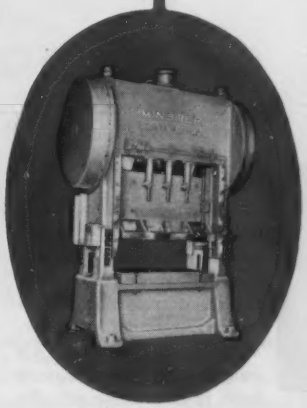
What did your scrapped stampings cost you this week in material, labor, machine time, production loss and rehandling?



Minster
Series 1 O.B.I. Presses



Minster
Series S-1 Presses



Minster
Series S-2 Presses

Minster Presses cut scrap loss, save you money because they provide:

1. Greater frame rigidity, with less deflection.
2. Extra long ways and gibs, widely spaced and precision finished, assure slide and bed parallelism.
3. Fast action, controlled cycling with Minster's patented Air Operated Combination Friction Clutch and Brake.
4. Minster Controls combine with fast clutch action to help reduce scrap caused by misfeeding.

Build a sound replacement program modernize with Minster Presses

THE MINSTER MACHINE COMPANY

MINSTER, OHIO

MINSTER®

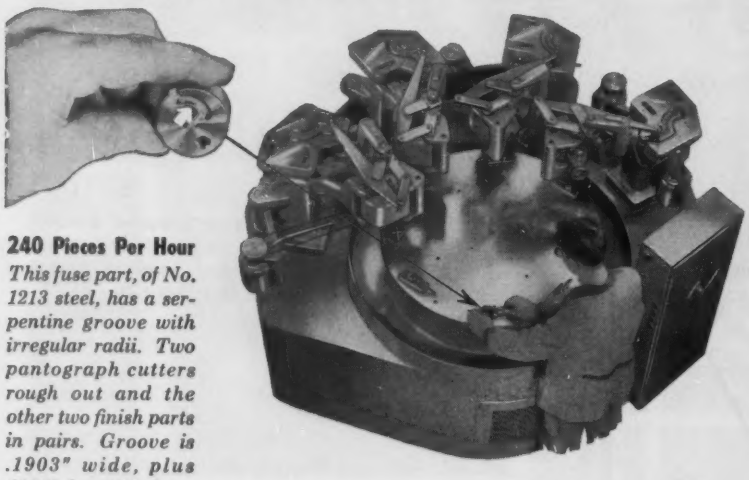
PRESSES

High Production

with GORTON MULTIPLE-SPINDLE INDEXING PANTOGRAPHS

Multiple operations with exceptional repetitive accuracy give you production-line performance on Gorton Multiple-Spindle Indexing Pantographs. From two to six different operations, performed at one setting, result in both precision and economy. Automatic cycling during engraving, milling, profiling, chamfering, counterboring, grooving or routing.

Infinitely variable feeds up to the capacity of any existing cutter. Reversing drive for conventional or climb milling.



240 Pieces Per Hour

This fuse part, of No. 1213 steel, has a serpentine groove with irregular radii. Two pantograph cutters rough out and the other two finish parts in pairs. Groove is .1903" wide, plus .0014", by .109" deep, plus .003". Finish: 35 mcr.

194 Pieces Per Hour

These die-cast spectacle frames incorporate "V"-shaped grooves or bezels for left- and right-hand lenses. The bezels do not lie in a horizontal plane but require a "rise and fall" in cutter movement to accommodate convex lenses. This machine mills grooves in both lenses automatically during the cutting cycle.

These machines are custom-built according to customers' specific requirements. With tooling changes, they have many different applications. Write for Forms 2595-DS1312 and 2604-DS1312 on Gorton Multiple-Spindle Indexing Pantographs.

GEORGE GORTON MACHINE CO., 1312 Racine St., Racine, Wis., U.S.A.

Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

BABBITT

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Casa Corp., 405 Lexington Ave., New York 17.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Keller Tool Co., Grand Haven, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Olsen, Tinius, Testing Maching Co., Philadelphia, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mich. Tool Co., 2531 11th St., Rockford, Ill.

BALLS

Kennametal, Inc., Latrobe, Pa.

BARS, Phosphor Bronze

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BARS, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., (Cold Drawn), Republic Bldg., Cleveland, Ohio.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BASES, Machinery Welded

Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.

BEARINGS, Babbitt

Bunting Brass & Bronze Co., Spencer and Carlton Ave., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Ball

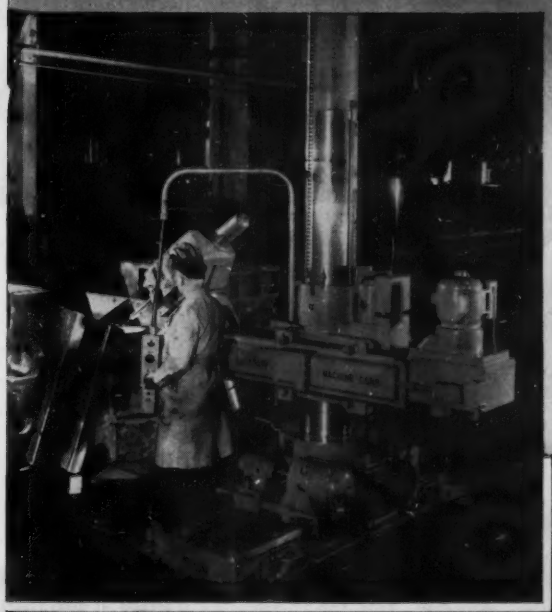
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., General Motors, Bristol, Conn.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Torrington Co., Torrington, Conn.

(*Continued on page* 288)

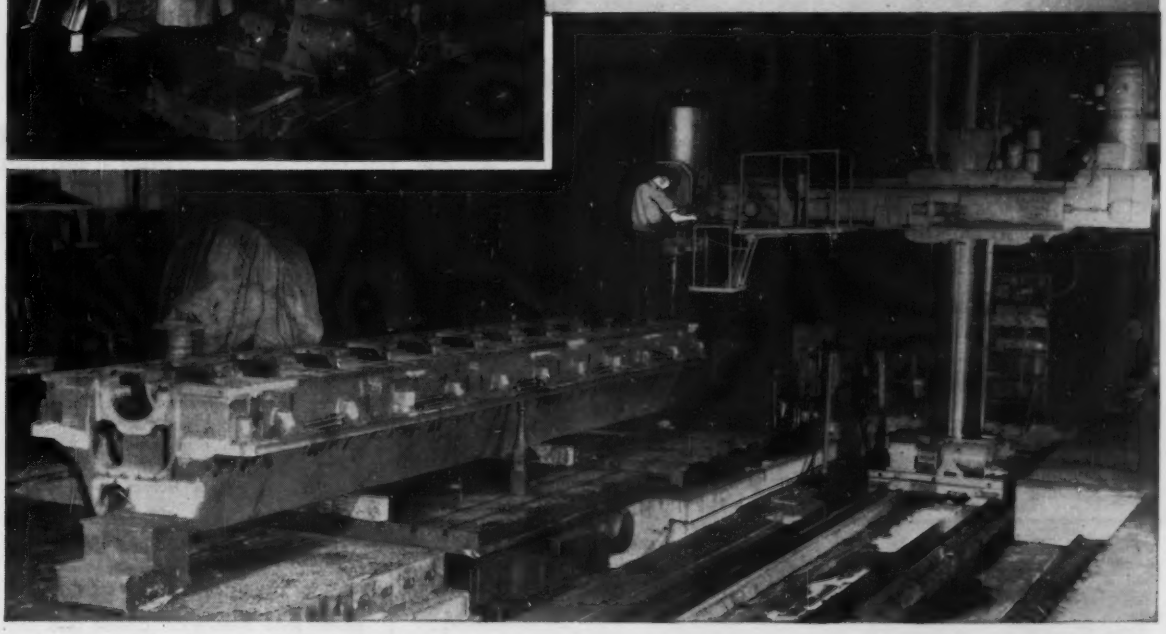
For more information on products advertised, use Inquiry Card, page 245

Kaukauna At Work....

UNIVERSAL RADIAL DRILLING MACHINES



Drilling angular holes in bore of casting is a job that requires accuracy, fast tool positioning and plenty of power to take full advantage of the highest feeds and speeds permissible with modern cutting tools. Kaukauna Universal Radial Drills have the power, accuracy and stamina to do this work quickly, easily and at low cost. A versatile line of machines with simplified controls, they maintain efficient high production on large, unwieldly workpieces or small production parts, and perform drilling, reaming, boring, counterboring, tapping and spot-facing operations. They do jobs that no other machines can do . . . save time and money.



With extended column, runway and reach, this Kaukauna Universal Radial Drilling Machine is saving set-up time by drilling, tapping, driving studs and spot-facing with speed and accuracy from any angle on diesel engine bases and blocks.

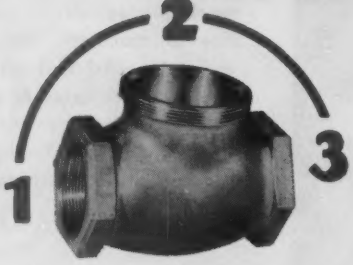
Kaukauna builds Universal Radial Drills and Horizontal Drilling Machines in a range of sizes which meet practically all requirements in modern production practice. Write today for descriptive catalog or ask representative to call.

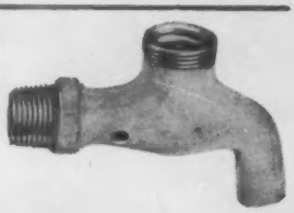
Kaukauna MACHINE CORPORATION

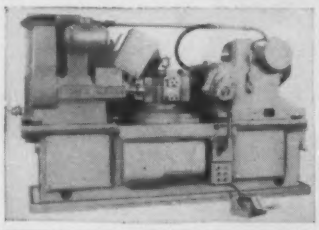
KAUKAUNA, WISCONSIN, U. S. A.

Single set-up covering ALL finishing operations...

MEANS GREATER ACCURACY with GOSS DeLEEUW







AUTOMATIC CHUCKING MACHINES

One of the many important advantages being realized with this new chucker is the performing of ALL finishing operations on a single chucking of the work. In addition to the time saved, this feature, exclusive with Goss & De Leeuw "1-2-3" machines, means only one handling of the work with an attendant greater accuracy. This machine is in a class by itself in precision finishing.

In Goss & De Leeuw "1-2-3" Automatic Chucking Machines, one, two, or three ends of the work are machined simultaneously or in sequence. There is no need for resetting, retooling or secondary operations. More work from one machine and greater accuracy are matters of record.

Ask for illustrated literature describing the operation of this chucker in detail. Send samples of your work for time and cost estimates.

GOSS & DeLEEUW — QUALITY · PRODUCT · QUANTITY

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

BEARINGS, Bronze and Special Alloy
Bunting Brass & Bronze Co., Spencer & Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Lineshaft
Fafnir Bearing Co., New Britain, Conn.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, Needle
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Orange Roller Bearing Co., Inc., Orange, N. J.
Torrington Co., Torrington, Conn.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Div., Harrison, N. J.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Railway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Self-Lubricating (Oilless)
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Tapered Roller
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

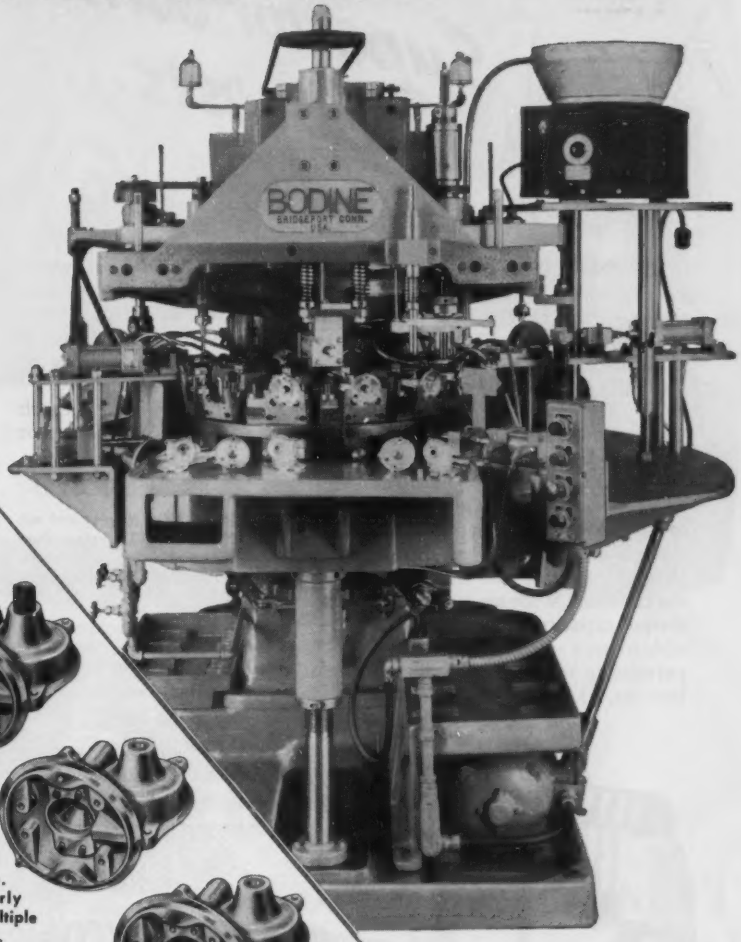
BELT SHIFTERS
Standard Pressed Steel Co., Jenkintown, Pa.

BELTING, Transmission
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

(*Continued on page* 290)

For more information on products advertised, use Inquiry Card, page 245

Bodine CASE HISTORY NO. 37



5
Spot face ⅝" dia. maintaining depth to ± .002".

6
Automatically hopper feed, transfer and insert Oilite bushing.

7
Drill 4 - #31 dia. (.120") holes and 1 - .1235" dia. hole (angularly mounted multiple drill head).

8
Tap 2 holes #10-32 with angularly mounted 2-spindle tap head.

9
Size I.D. of Oilite bushing to .3735" - .3745" dia.

PROCESSING WINDSHIELD WIPER MOTOR HOUSINGS

PRODUCTION
One piece per stroke . . . 20 strokes per min. — 1000 pieces per 50-min. hour. 10,000 individual operations per 50-min. hour.

MATERIAL
S.A.E. #925 Die Casting (Parts No. EMG-2, EMG-3, right- and left-hand).

TOLERANCES
(Other than specified above) Drilled holes: Size .001". Location: ± .002". Tapped holes: Class 2 threads.

MACHINE
Bodine Model 42-30 Drilling, Tapping, Assembling Machine.
Write us for Bodine Brochure M-12 "12 Case Histories."

"You Can't Meet Tomorrow's Competition With Yesterday's Machine Tools."

THE **Bodine** CORPORATION
BRIDGEPORT CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

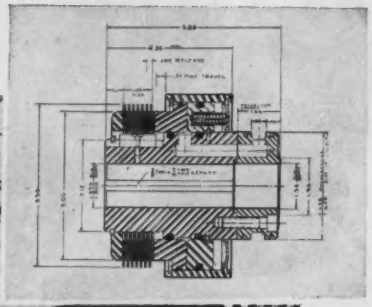
BLUEPRINT TO

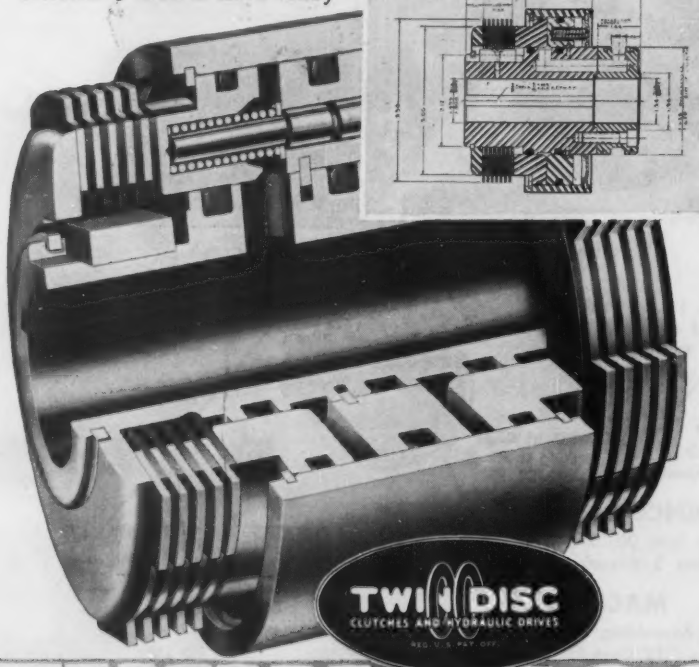
Superior control, lower costs...

CONSIDER the *outstanding* advantages you will gain by designing Twin Disc Oil-Actuated Multiple Plate Clutches into your machines: 1 You'll *eliminate entirely* the need for clutch adjustment, and maintain *constant torque.* The integral oil cylinder acts as a floating pressure plate, *automatically increasing in travel as the plate stack wears.* The torque value *cannot* decrease . . . there is *no* chance for an inexperienced operator to "burn up" the clutch. 2 With *high, constant* torque capacity, it is often possible to use a *smaller* size clutch—permitting more *compact* installations. 3 You'll have *ready adaptability to remote control,* eliminating complicated actuating linkage. 4 You'll benefit from *consistently longer wear-life,* since there is no possibility of plate slippage.

Write to Twin Disc Clutch Company, Racine, Wisconsin, for *complete* information.

Blueprint of Model MOS (single) and cutaway view of Model MOD (duplex) show interlocked pistons of Twin Disc Oil-Actuated Multiple Plate Clutch. Write for latest Bulletin No. 305.





TWIN DISC

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin • HYDRAULIC DIVISION, Rockford, Illinois

Branches or Sales Engineering Offices: Cleveland • Dallas • Detroit • Los Angeles • Newark • New Orleans • Seattle • Tulsa

BENCHES, Work, and Bench Legs
Standard Pressed Steel Co., Jenkintown, Pa.

BENDING MACHINES, Angle Iron, Plate, Etc.
Consolidated Mch. Tool Corp., 565 Blossom Rd., Rochester, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

BENDING MACHINES, Hydraulic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 30 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BENDING MACHINES, Pipe
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

BLAST CLEANING EQUIPMENT
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pangborn Corp., Hagerstown, Md.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

BLOWERS
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

BLUING LAYOUT
Dykem Co., 2303P. N. 11th St., St. Louis 6, Mo.

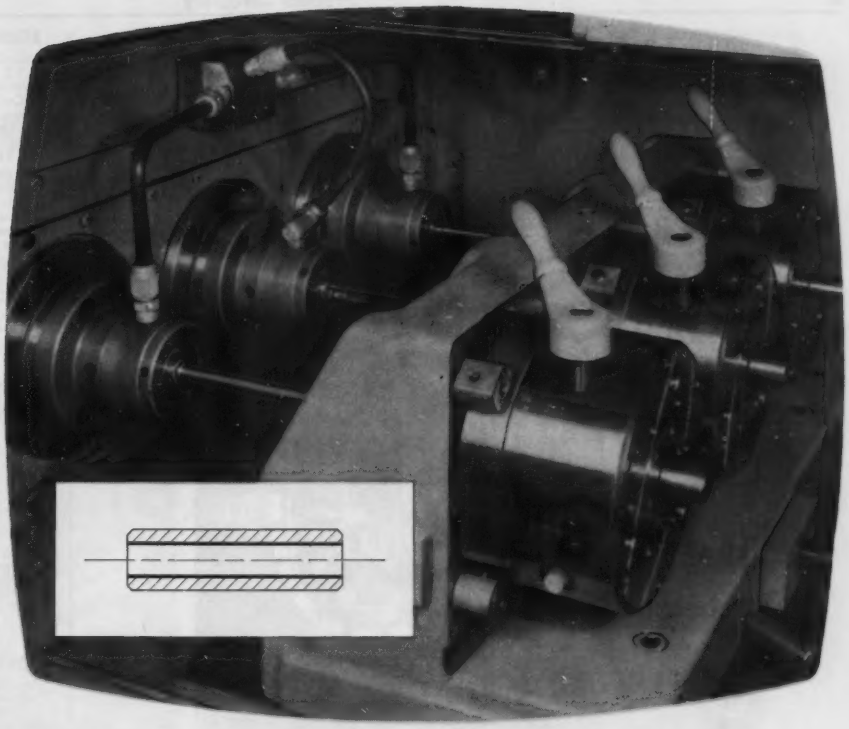
BOILER TUBES
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Steel and Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BOLTS AND NUTS
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only)
Bethlehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

(Continued on page 292)

Get precision drilling results like this...

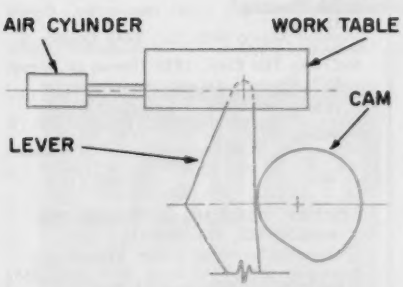


Part – Titanium alloy tube, 30 Rockwell "C"
Operation – Precision drill hole from solid
Hole dimensions – .450 & .010 dia. x 2 25/32" long
Cutting Speed – 1168 R. P. M., 160 S. F. M.
Feed – .701 P. M., Lead: .0006
Finish required – 75 micro-inches or better
Production – 40 pieces per hour at 100%

... on the BRYANT precision boring machine!

This Bryant Boring Machine, plus years of Bryant research, opens up new possibilities for you in precision boring, drilling, turning, facing, grooving and contour boring and turning. It enables you to produce uniform fine finishes ... at peak production rates ... with highest repetitive accuracy.

The basic rigid machine design, and research-proven tooling and fixtures, make the Bryant 998 ideal for precision drilling techniques. The table is actuated mechanically by a precision cam and lever unit. This feature provides positive control of the cycle at all times and eliminates variation due to temperature change of a hydraulic system. Fine finishes are assured by the smooth, uniform table motion. The table moves on two 4"-diameter solid steel slide bars firmly bolted to the bed. Two anti-friction, preloaded ball bearings on each of these bars support the table. This construction provides a metal-to-metal contact which eliminates shifting due to oil film. *Write for Bryant 998 Job Folder.*



BRYANT

chucking grinder co.

SPRINGFIELD, VERMONT, U.S.A.

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates

IN THE CENTER OF A

Miniature tornado

LEBANON STEEL Castings are at work

WHIPPING up a wind as high as 120 mph is the job of Elliott Company's Single-Stage Centrifugal Blowers. In these blowers the "tornado-builder" is a one-piece, open type, radial-bladed impeller—a Lebanon CIRCLE (L) casting engineered to withstand unusual service conditions.

These Elliott Blowers are widely used by the Chemical (particularly in sulphuric acid plants), Power, Refining and Gas industries where they run continuously, 24 hours a day. Such difficult service requires excellence of product design and manufacture, for a stopped blower can mean a plant shut-down. That Lebanon CIRCLE (L) castings are specified by Elliott is recognition, we believe, of the superior workmanship that is traditional with Lebanon Steel Foundry craftsmen.

See—STEEL WITH A THOUSAND QUALITIES—37-min., 16 mm, full-color, sound film on the making of steel castings. For information write: Dept. X, Lebanon Steel Foundry.

LEBANON Castings

CARBON, SPECIAL ALLOY AND STAINLESS STEEL

LEBANON STEEL FOUNDRY LEBANON, PA.

BOOKS, Technical

Industrial Press, 148 Lafayette St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

BORING AND DRILLING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Canedy-Otto Div. Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

BORING AND TURNING MILLS, Vertical

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING BARS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

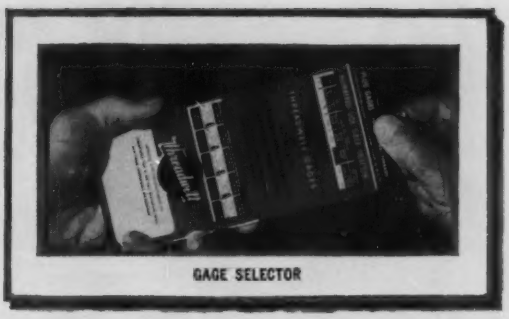
BORING, DRILLING AND MILLING MACHINES, Horizontal
(Floor, Planer or Table Types)

Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.

(*Continued on page* 294)

For more information on products advertised, use Inquiry Card, page 245

selected for service



GAGE SELECTOR

NET PRICE SELECTORS

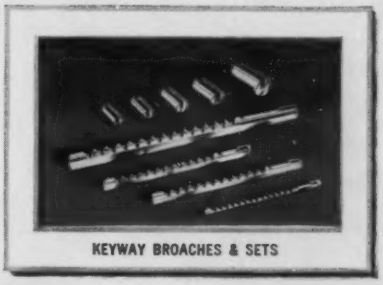
For the convenience of cutting tool and fixed gage users and buyers Threadwell presents two more services for more efficient and economical production:

NEW THREAD GAGE SELECTOR—a complete pocket-size tabulation of basic data for thread plug and ring gages, both fractional and numbered sizes from No. 0 to 1½".

NEW NET PRICE SELECTORS—provide quick data on all standard taps, dies, tap and die kits, counterbores and keyway broaches; simply pick the size and style wanted and get the net price instantly.

Ask your Threadwell distributor for these two new members of the Threadwell service family. Ask him too about the long service life of Threadwell's fine cutting tools and gages.

ADJUSTABLE ROUND, 2-PIECE & HEXAGON DIES



KEYWAY BROACHES & SETS

COMPLETE LINE OF HIGHEST PRECISION GAGES

THREADWELL DISTRIBUTORS, too, are strategically located to serve you promptly, properly, and well.

THE FINEST IN CUTTING TOOLS & GAGES

...thermal sensing unit

C·P·I PLUGSTAT®

—wherever temperature limit indication is required

CPI PLUGSTATS provide precise thermal warning without calibration drift. Small physical size has been combined with rugged construction. Special alloy contacts assure clean make-and-break. Capable of 200°F overshoot from high or low normal setting. Available also with AN connector. Rated at ¼ ampere, 28 volts, AC or DC resistive loads. Contacts NO or NC. Weight approx. 1.5 oz.

Proven dependable in —
AIRCRAFT GENERATORS
AIR COOLED ENGINES
WATER COOLED ENGINES
TRUCK REAR ENDS
MARINE ENGINES
BEARINGS
PIPED LIQUIDS
GEAR BOXES

CONTROL PRODUCTS INC

320 SUSSEX STREET
HARRISON, NEW JERSEY

Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Mummert-Dixon Co., Hanover, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Bryant Chucking Grinder Co., Springfield, Vt.
Chandler Tool Co., 514 Ohio Ave., Muncie, Ind.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Simplex Machine Tool Corp., 4528 W. Mitchell St., Milwaukee, Wis.

BORING MACHINES, Jig

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

BORING TOOLS

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.

(*Continued on page* 298)

For more information on products advertised, use Inquiry Card, page 245

PAN AMERICAN

Grinds holes plus 0.0003", minus 0.0000"

on RIVETT

Magneto Bearing Support. Bearing size is 1.5749" dia. Tolerance is plus 0.0003", minus 0.0000".

Rivett Model 1024 Internal and Universal Grinder. Double-end wheelhead swivels 180° for quick conversion. Holes to 9" dia., external to 12" dia. Collets mount directly in workhead spindle.

Maintenance contributes to Pan American World Airways System's excellent reputation for safety and dependability.

At the Latin American Division Overhaul Base in Miami, Fla., Pan American has been using a Rivett Model 1024 Internal and Universal Grinder on small hole work for 3½ years.

Pan Am states: *"The Rivett Grinder is in operation during two eight-hour shifts per day, five days per week. The only service has been lubrication and replacement belts. It is considered the most accurate and productive universal grinder in the shop. We have another machine on order."*

This testimony to Rivett accuracy and productivity has company in similar statements by other Rivett users. Write for Bulletin 1024B and get the details of how Rivett can improve your toolroom and small lot grinding.

RIVETT LATHE & GRINDER, INC., BRIGHTON 35, BOSTON, MASS.

Rivett Lathe & Grinder, Inc.
Dept. MR12, Brighton 35, Boston, Mass.
Send Free 12-page Catalog 1024B.

Name_____

Company_____

City_____ State_____

RIVETT

A Symbol of Accuracy in Machine Tools

More than a "Coolant"
CUTTING
OIL BAS
EME PRESSU
UBRICANTS
QUENCHING AND
TEMPERING OILS
DRAWING
OMPOUNDS
CHINE TOOL
UBRICANTS
YDRAULIC
FLUIDS
BALANCED
CUTTING OILS
ATER-MIX
OMPOUNDS
KLEENKUT • SOLVOL • UT • ELENE • THREDKUT •

is needed . . .

3 STEPS TO SUPERIOR PERFORMANCE

To help you select the right industrial lubricant to do the best job. Consider all three carefully.

As the cutting tool meets the workpiece and chips start peeling off. . . lubrication and temperature control become of prime importance. More than a "coolant" is needed now to produce the optimum in production, finish and tool life. The cutting fluid must have superior lubricity, temperature control and chemical activity to properly eliminate scuffing of the tool and workpiece, reduce frictional wear and provide high anti-weld characteristics to prevent metallic seizure.

The D. A. Stuart Oil Company's modern laboratory is constantly at work developing industrial lubricants that are *just right for your job!* These include straight oil type cutting and grinding fluids, water-mix cutting and grinding fluids, drawing and stamping compounds, and lubricating oils and greases for gears, bearings and machine tool ways. For the best guide to the *right* industrial lubricant that will save you time, money and material, contact "the Man in the Barrel", your Stuart Representative. He knows how to solve your industrial lubrication problems. Fill in the coupon below today. . . ask to have him call.

1. LUBRICITY

The characteristic of an industrial lubricant that reduces scuffing of the work and tool. Proper lubricity can eliminate rough finish, stop tearing of threads and sharp edges and promote proper chip formation.

2. TEMPERATURE CONTROL

Temperature regulation helps provide maximum efficiency—ignored, it can ruin efficiency. Excessive heat can change the character of a metal—temperature fluctuation will cause irregular chip formation or may even make it impossible.

3. CHEMICAL ACTION

Additives are introduced to industrial lubricants to produce super lubricity and anti-weld characteristics that prevent scuffing and seizure. However, chemical activity must be *carefully balanced* and *controlled* to meet job conditions and provide best results. Too much additive causes excessive wear . . . too little results in scuffing, seizure and rough finish.

THE Stuart TRIANGLE

Represents the pooling of experience and technical information from Stuart's Laboratory, field men and product users regarding the selection of the *right* cutting fluid to do the best job!

"The Man in the Barrel" knows how to obtain superior performance with industrial lubricants. When you're in doubt . . . contact Stuart Oil Company.

D. A. Stuart Oil Co. LIMITED
EST 1865

TIME-TESTED CUTTING FLUIDS AND LUBRICANTS

2739 S. Troy St., Chicago 23, Illinois
In Canada: Canadian D. A. Stuart Oil Co., Ltd.
3575 Danforth Ave., Toronto

CLIP TO YOUR COMPANY LETTERHEAD AND MAIL TO

D. A. Stuart Oil Company
2739 S. Troy Street, Chicago 23, Illinois

☐ Please have Stuart Representative call.

☐ Please send copy of booklet titled Stuart's Cutting Oil Bases.

Name .....

Title .....

THREDKUT 99 • SUPERKOOL • CODOL • DASCO • STURACO E. P. LUBES

Another Cleveland Design to Speed Production!

COMBINATION CLEVELAND REAMING AND THREADING MACHINE

PARTS: LB type fittings with external threads. Vapoil Connector Bodies 90°. Vapoil Connector Bodies straight.

MATERIAL: LB type fittings of Malleable Iron; other parts of cast aluminum.

A vertical combination machine consisting of a heavy duty Cleveland 21" Power Index Table, mounted on an all welded and normalized steel base with columns to support the machined units.

Send for your copy of this Guide

The tapping unit is Model E-3 Cleveland Lead Screw Production Tapping Head.

Mounted on top plate, six hand operated locating and clamping fixtures, with interchangeable jaw sets.

Write today for Catalog No. MY-124

CLEVELAND
tapping machine co.
A Subsidiary of AUTOMATIC STEEL PRODUCTS, INC. • CANTON 6, OHIO

Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bliss, E. W., Co., 1375 Raff Road, S. W., Canton, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. Y.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BROACHING MACHINES

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Foote-Burt Co., 130 St. Clair Ave., Cleveland 8, Ohio.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Zagar Tool Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BRONZE

American Brass Co., Waterbury 20, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Wire Wheel, Etc.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.
Pittsburgh Plate Glass Co., Brush Div., Baltimore 29, Md.

BUFFERS

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md. (Portable Elec.).
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.

BULLDOZERS

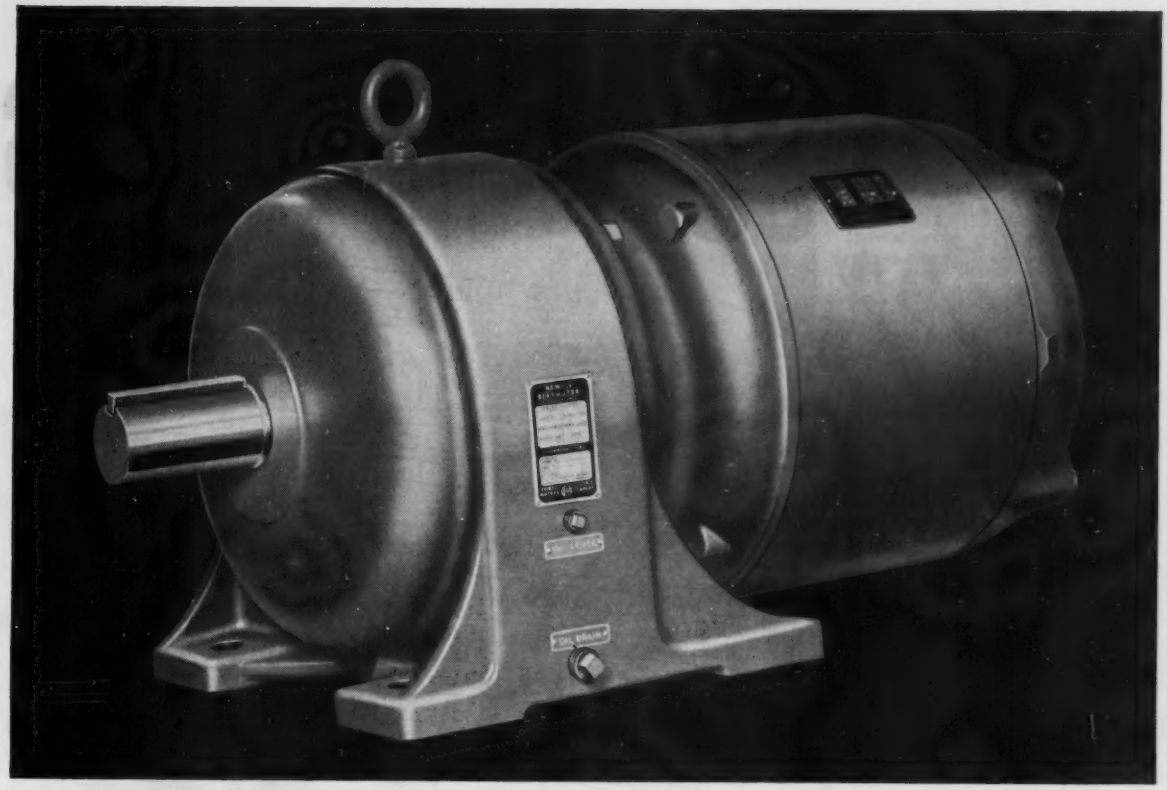
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

BURS

See Files and Burs, Rotary

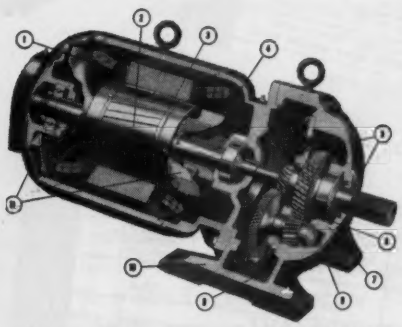
(*Continued on page* 302)

For more information on products advertised, use Inquiry Card, page 245



The power you need at the speed you need it . . .

HOWELL GEAR MOTORS



11 reasons why Howell Gear Motors last longer, serve you better

1. High-quality insulation
2. Copper-clad rotor
3. Expert craftsmanship
4. High-quality coil varnish
5. Leakproof oil seals
6. Duti-Rated Lifetime Gearing
7. Unit case construction with integral bearing housings
8. Corner-mounted offset shaft
9. Large oil reservoir
10. Heavy, cast-iron construction
11. Superior cooling

New dependability, greater starting torque and top efficiency, with output speeds as low as 7.5 rpm. are now available in Howell Gear Motors.

This compact, single-unit motor may well be the answer to your gear reduction problems. Combining the finest in heavy duty industrial gearing with the best in motoring, Howell Gear Motors reduce drive failures and production downtime.

Howell Gear Motors use duti-rated, lifetime gearing, with file-hard tooth surfaces and tough, resilient cores. They are available in all types of enclosures, from 7.5 to 780 rpm. with a capacity range from 1 to 150 hp., in all three AGMA service classifications.

For full information on Howell Gear Motors, contact the Howell man in your area, or write the factory direct for Bulletin GM-1.

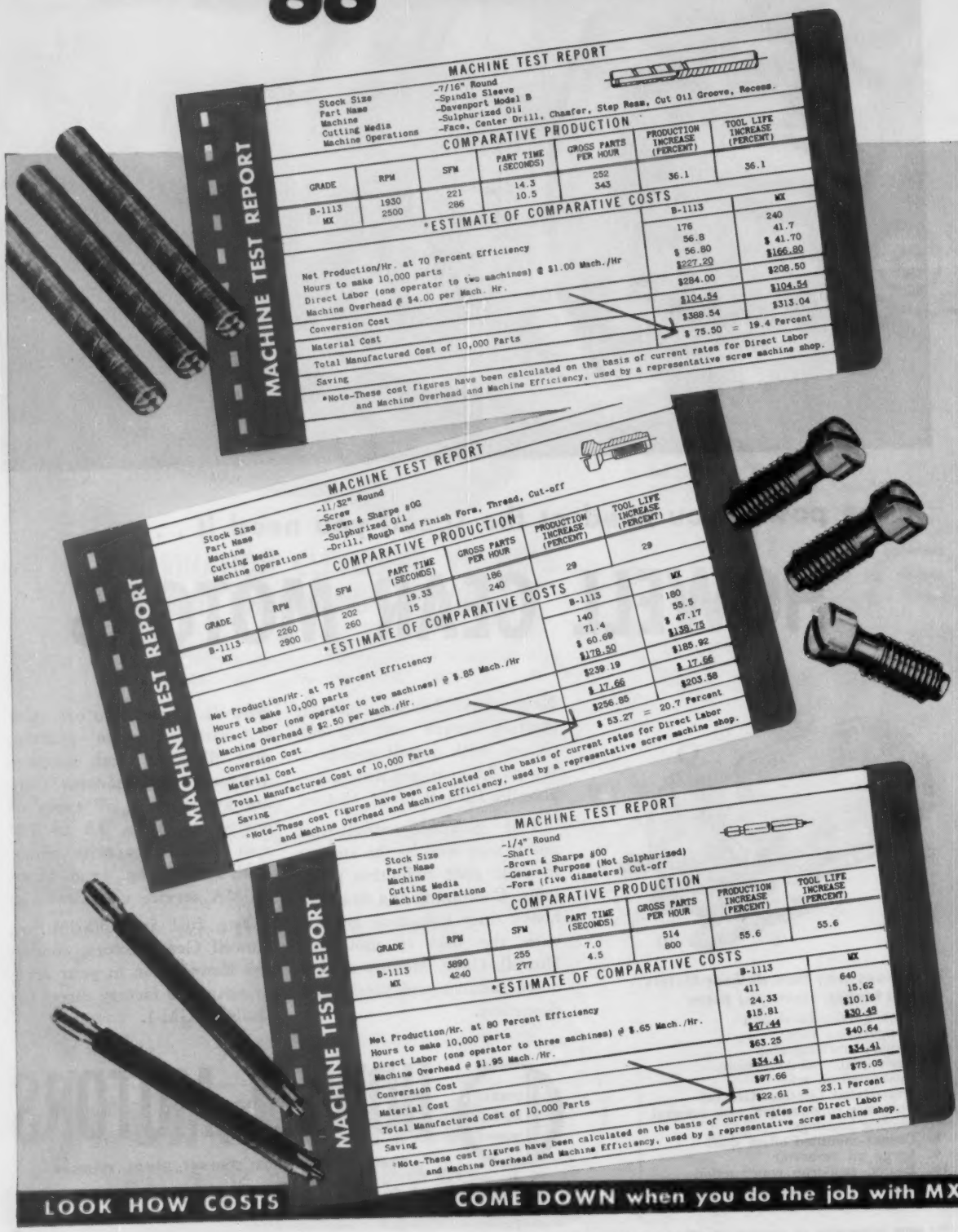
HOWELL RedBand MOTORS

HOWELL MOTORS

HOWELL ELECTRIC MOTORS COMPANY, HOWELL, MICHIGAN

MOTORS FOR INDUSTRY SINCE 1915

Get bigger dividends


MACHINE TEST REPORT
Stock Size -7/16" Round
Part Name -Spindle Sleeve
Machine -Davenport Model B
Cutting Media -Sulphurized Oil
Machine Operations -Face, Center Drill, Chamfer, Step Ream, Cut Oil Groove, Recess.
COMPARATIVE PRODUCTION
GRADE | RPM | SFM | PART TIME (SECONDS) | GROSS PARTS PER HOUR | PRODUCTION INCREASE (PERCENT) | TOOL LIFE INCREASE (PERCENT)
B-1113 | 1930 | 221 | 14.3 | 252 | 36.1 | 36.1
MX | 2500 | 286 | 10.5 | 343
*ESTIMATE OF COMPARATIVE COSTS
B-1113 | MX
Net Production/Hr. at 70 Percent Efficiency | 176 | 240
Hours to make 10,000 parts | 56.8 | 41.7
Direct Labor (one operator to two machines) @ $1.00 Mach./Hr | $ 56.80 | $ 41.70
Machine Overhead @ $4.00 per Mach. Hr. | $227.20 | $166.80
Conversion Cost | $284.00 | $208.50
Material Cost | $104.54 | $104.54
Total Manufactured Cost of 10,000 Parts | $388.54 | $313.04
Saving | $ 75.50 = 19.4 Percent
*Note-These cost figures have been calculated on the basis of current rates for Direct Labor and Machine Overhead and Machine Efficiency, used by a representative screw machine shop.
MACHINE TEST REPORT
Stock Size -11/32" Round
Part Name -Screw
Machine -Brown & Sharpe #0G
Cutting Media -Sulphurized Oil
Machine Operations -Drill, Rough and Finish Form, Thread, Cut-off
COMPARATIVE PRODUCTION
GRADE | RPM | SFM | PART TIME (SECONDS) | GROSS PARTS PER HOUR | PRODUCTION INCREASE (PERCENT) | TOOL LIFE INCREASE (PERCENT)
B-1113 | 2260 | 202 | 19.33 | 186 | 29 | 29
MX | 2900 | 260 | 15 | 240
*ESTIMATE OF COMPARATIVE COSTS
B-1113 | MX
Net Production/Hr. at 75 Percent Efficiency | 140 | 180
Hours to make 10,000 parts | 71.4 | 55.5
Direct Labor (one operator to two machines) @ $.85 Mach./Hr | $ 60.69 | $ 47.17
Machine Overhead @ $2.50 per Mach./Hr. | $178.50 | $138.75
Conversion Cost | $239.19 | $185.92
Material Cost | $ 17.66 | $ 17.66
Total Manufactured Cost of 10,000 Parts | $256.85 | $203.58
Saving | $ 53.27 = 20.7 Percent
*Note-These cost figures have been calculated on the basis of current rates for Direct Labor and Machine Overhead and Machine Efficiency, used by a representative screw machine shop.
MACHINE TEST REPORT
Stock Size -1/4" Round
Part Name -Shaft
Machine -Brown & Sharpe #00
Cutting Media -General Purpose (Not Sulphurized)
Machine Operations -Form (five diameters) Cut-off
COMPARATIVE PRODUCTION
GRADE | RPM | SFM | PART TIME (SECONDS) | GROSS PARTS PER HOUR | PRODUCTION INCREASE (PERCENT) | TOOL LIFE INCREASE (PERCENT)
B-1113 | 3890 | 255 | 7.0 | 514 | 55.6 | 55.6
MX | 4240 | 277 | 4.5 | 800
*ESTIMATE OF COMPARATIVE COSTS
B-1113 | MX
Net Production/Hr. at 80 Percent Efficiency | 411 | 640
Hours to make 10,000 parts | 24.33 | 15.62
Direct Labor (one operator to three machines) @ $.65 Mach./Hr. | $15.81 | $10.16
Machine Overhead @ $1.95 Mach./Hr. | $47.44 | $30.48
Conversion Cost | $63.25 | $40.64
Material Cost | $34.41 | $34.41
Total Manufactured Cost of 10,000 Parts | $97.66 | $75.05
Saving | $22.61 = 23.1 Percent
*Note-These cost figures have been calculated on the basis of current rates for Direct Labor and Machine Overhead and Machine Efficiency, used by a representative screw machine shop.
LOOK HOW COSTS COME DOWN when you do the job with MX

from your screw stock

...do the job with MX

the freer-machining screw stock
available in both Bessemer and Open Hearth

USS MX FREE-MACHINING STEEL pays off in four ways—

MX lowers the cost per part by increasing the rate of production.

MX reduces down time and costly grinding by prolonging tool life.

MX often eliminates extra finishing operations by assuring better part finish.

MX helps to minimize rejection by providing closer dimensional accuracy.

These are facts proved in hundreds of shops that have used MX in more than a billion parts . . . parts of infinite variety turned out under dissimilar conditions and on screw machine equipment of many types.

USS MX Free-Machining Steel works *with* your tools—not against them. It is designed to ensure maximum cutting speeds compatible with economical tool life. As a result, production goes up and costs come down wherever fast-cutting MX is put to work.

From the many case histories we have on file, we feel that MX will cut the cost of *any* part you now machine from ordinary screw stock. You can prove this for yourself by giving MX a trial on your own machines.

And remember: Although USS MX Free-Machining Steel costs no more than ordinary screw stock, *it has been successfully machined at speeds approaching 350 SFM*—speeds far higher than the *average* speeds (under 250 SFM) used in most shops today.

So if you want lower material costs, a profitable rate of production, long tool life and good finish, your best bet is USS MX, either Bessemer or Open Hearth.

USS MX Free-Machining Steel is produced in all the popular screw stock sizes. It is sold in cold-finished form by your regular supplier either as "MX" or under his own identifying trade name. In hot-rolled form, MX is available through our nearest district sales office.

UNITED STATES STEEL CORPORATION, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO · TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

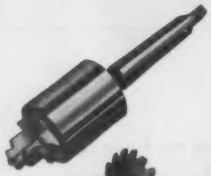
UNITED STATES STEEL

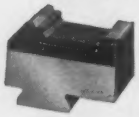
for Special Service on Carbide "Specials"

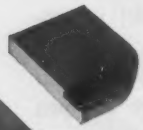
GORHAM

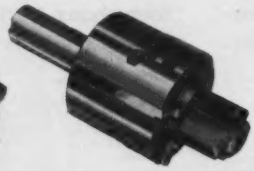
GORHAM

GORHAM









When your production machining problem dictates the use of special carbide tooling, your nearby Gorham Field Engineer can give you the right answers fast! He's an expert in the design and application of special cutting tools . . . and he provides a complete engineering service to determine your exact requirements.

He begins with your product, sketch or idea. He surveys your production operations and available equipment. He considers work material properties and required finishes and tolerances. He plots speeds, feeds and methods of tool driving. Then he develops practical design and metallurgical specifications for a special tool that's "tailor-made" for your application. And his recommendations are backed by Gorham's more than thirty years' experience in the design, manufacture and heat treatment of fine cutting tools.

Yes, your nearby Gorham Field Engineer is a helpful man to have around! If you haven't yet met him, write for his name, or send details of your problem direct, and we'll have him get in touch with you promptly.

Gorham TOOL COMPANY

"EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"

14405 WOODROW WILSON DETROIT 3, MICHIGAN

WEST COAST WAREHOUSE: 576 North Prairie Ave., Hawthorne, Calif.

BUSHINGS, Brass, Bronze, Carbide, Etc.

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Johnson Bronze Co., New Castle, Pa.
Kennametal, Inc., Latrobe, Pa.

BUSHINGS, Hardened

Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

BUSHINGS, Jig

Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

CALIPERS

Ames, B. C., & Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

CAM CUTTING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springeld, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CAM MILLING AND GRINDING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Waynesboro, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rowbottom Machine Co., Waterbury, Conn.

CAMS

Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.
Willey's Carbide Tool Corp., 1340 W. Vernor Hwy., Detroit 1, Mich.

CASEHARDENING FURNACES

See Furnaces, Heat-Treating

(*Continued on page* 304)

For more information on products advertised, use Inquiry Card, page 245

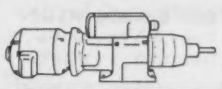
Swanson TURRET INDEXING UNITS

Lower the cost of Automation

These versatile, "packaged" units provide the basic chassis for a wide range of special automatic machines for precision machining, processing or assembling operations on small and medium parts. Because they eliminate much of the engineering and building time formerly required, Swanson units lower costs and shorten completion time . . . considerably broadening the practical applications for automation. Further, because of the simplicity with which standard or special operational devices can be grouped around the turret, a wide latitude of tooling arrangements is possible. Interchangeable turret assemblies and mounting brackets are available for complete tooling changeover.

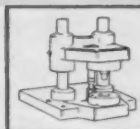
ONLY SWANSON PROVIDES A STANDARD TURRET INDEXING CHASIS WITH THESE FEATURES:

Stationary center plate for mounting or supporting operational devices.

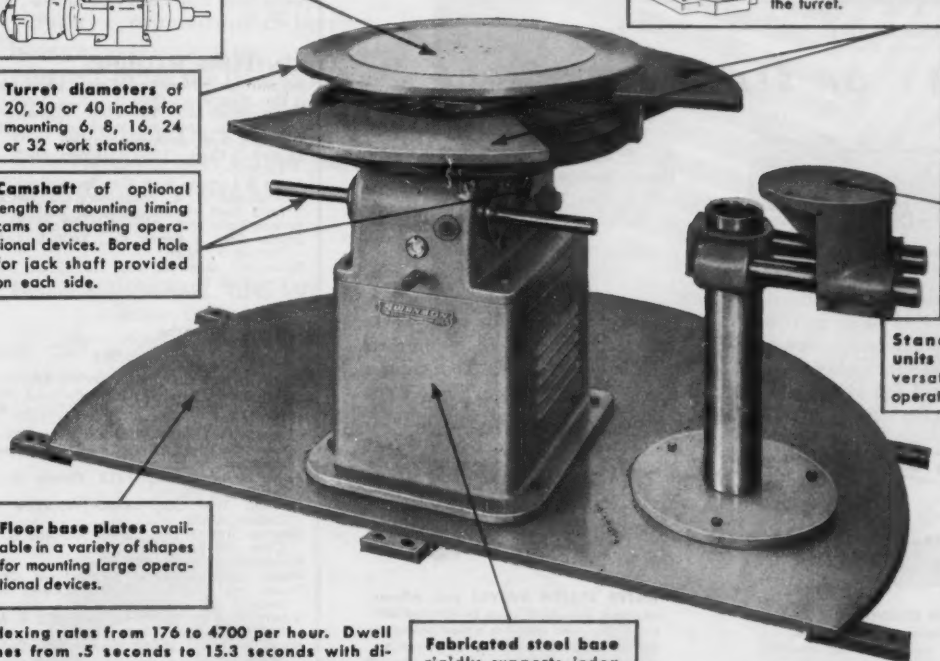


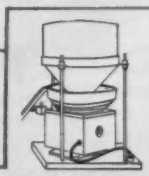
Turret diameters of 20, 30 or 40 inches for mounting 6, 8, 16, 24 or 32 work stations.

Camshaft of optional length for mounting timing cams or actuating operational devices. Bored hole for jack shaft provided on each side.



Mounting brackets of optional widths may be located on radial keyway in any positions around the turret.





Standard pedestal units provide additional versatility in mounting operational devices.

Floor base plates available in a variety of shapes for mounting large operational devices.

Indexing rates from 176 to 4700 per hour. Dwell times from .5 seconds to 15.3 seconds with direct drive . . . to infinity with intermittent drive models. Exclusive cross-over cam and locking device assure harmonious indexing and accurate positioning at all work stations.

Fabricated steel base rigidly supports index housing and encloses motor, drive and wiring.

Write for Bulletin TM

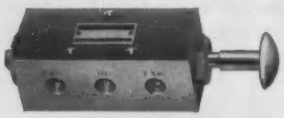
Quality SWANSON TOOL & MACHINE PRODUCTS INC., ERIE, PA. *Since 1910*

ENGINEERS AND BUILDERS OF SPECIAL AUTOMATIC MACHINERY

NEW, INEXPENSIVE, HIGHLY EFFICIENT

"O" Quick-As-Wink® TYPE" VALVES

NOW AVAILABLE

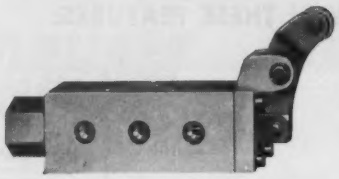


BUTTON OPERATED
(Push-Pull or Push Spring Return)

DIAPHRAGM OPERATED

FOR A WIDE

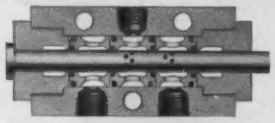
PILOT CYLINDER OPERATED
(Single or Double Pilot)



CAM OPERATED

VARIETY OF SERVICES

SOLENOID OPERATED
(Single or Double Solenoid)



CUT-AWAY VIEW OF INTERIOR
U. S. Pat. No. 2,645,450

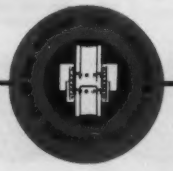
● These newly developed valves combine greatly simplified construction, positive positioning of all parts and quick, easy repacking in the field. There is no direct impingement of flow across the packings, greatly prolonging their life. All metal parts are aluminum except the hollow, radially ported, stainless steel plunger. ⅛" and ¼" pipe connections. 2, 3, 4 and 5-way actions. Write for Bulletin No. 531 today! *It gives full details.*

Ask us also about . . .

SINGLE PLUNGER SOLENOID VALVES
In single or double solenoid designs. Low amperage requirement eliminates intermediate relays and simplifies electrical control circuits.

WATER SYSTEM VALVES pilot cylinder operated, sizes to 8". Can be installed with automatic remote control as a plant protection measure to shut off water to certain parts of the plant in case of emergency so the entire available supply is directed where it is most needed.

Quick-As-Wink
AIR AND HYDRAULIC
Control Valves



Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated

Mfd. by C. B. HUNT & SON, INC., 1944 East Pershing St., Salem, Ohio

CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.

CASTINGS, Die

American Brass Co., Waterbury 20, Conn.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Madison-Kipp Corp., Madison, Wisc.

CASTINGS, Iron

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.

CASTINGS, Steel, Alloys, Etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Lebanon Steel Foundry, Dept. J, Lebanon, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

CEMENT, Disc Grinding Wheel

Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTERING MACHINES

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CENTERS, Lathe

Axelson Mfg. Co., P.O. Box 15335, Verona St., Los Angeles 58, Cal.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

(*Continued on page* 306)

For more information on products advertised, use Inquiry Card, page 245

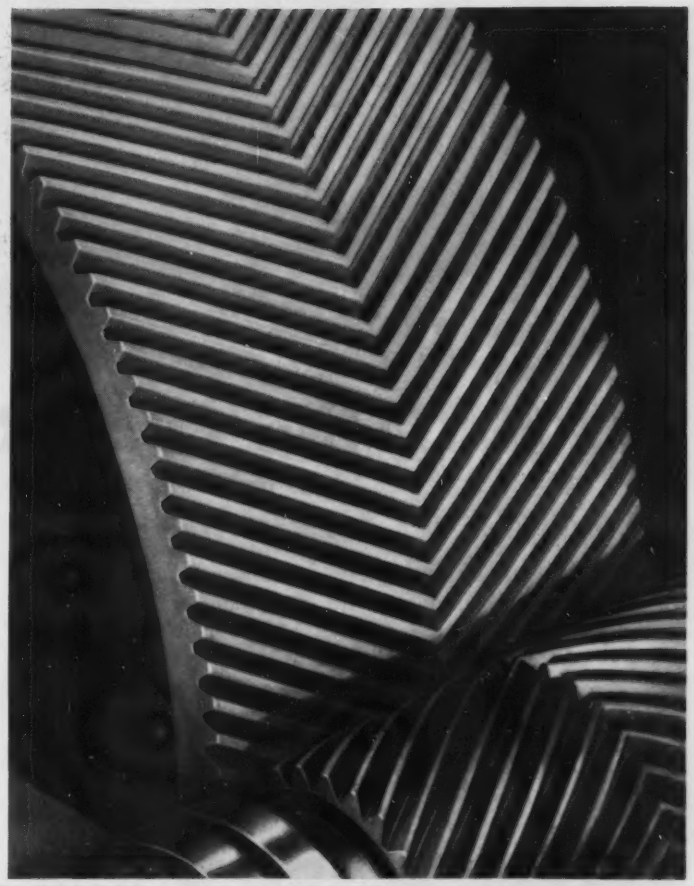
Farrel Gears...

for tough-job applications

The *backbone* in Farrel continuous-tooth herringbone gears, formed by the meeting of the two helices without a center groove, puts the *entire* face width of the gear to work for you.

This provides extra strength and greater capacity for wear and shock resistance—especially important in *tough-job* applications like those below. The opposed helices balance and absorb axial thrust within the gear member, preventing harmful thrust loads with resultant stresses on other parts of the machinery.

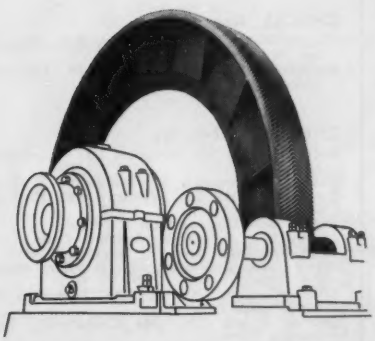
Farrel continuous-tooth herringbone gears are made of the finest grade materials, in any size from ¼ inch to 20 feet in diameter. Send for information about these gears, or, if you prefer, a Farrel engineer will be glad to assist you in working out unusual gear problems.



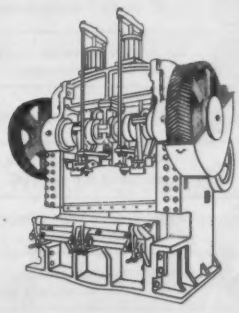
FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT
Plants: Ansonia and Derby, Conn.
Buffalo and Rochester, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Boston, Akron, Detroit, Chicago, Memphis, Minneapolis, Fayetteville (N. C.), Los Angeles, Salt Lake City, Tulsa, Houston, New Orleans

FB-971

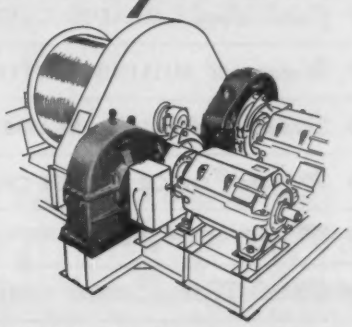
Farrel-Birmingham ®



Ball mill equipped with Farrel-Sykes gears.



Shear for cutting mild steel 3" thick by 120" wide.



Skip hoist driven by two motors through Farrel speed reducers.

McCROSKY

1904-1954 COST CUTTING TOOLS 50TH ANNIVERSARY

3/8" - 7/16" - 1/2" and 5/8" THIN SLOTTING CUTTERS

4" — 5" — 6" — 8" — 10" and 12" in diameter

with Jack-Lock® blade locking wedges

• Developed by McCrosky, these new cutters combine the rigidity of solid slotters with the greater economy — longer life — the easy, positive locking of each blade — and the quick release and accurate blade adjustment of McCrosky's shop-proved Jack-Lock Wedge. Locking pressure of the wedges against the alternate right and left hand milled and ground blades is parallel to the sides of the cutter, avoiding any side stress, warping or misalignment. Easily converted into half side cutters by simply inserting blades all of one hand. New bulletin gives dimensions and full details. *Write for Bulletin 17-M today.*

McCROSKY TOOL CORPORATION MEADVILLE, PA.

Engineering and Sales Representatives in the Principal Cities

Jack-Lock® MILLING CUTTERS	3" to 24" in diameter.
Universal MILLING CUTTERS	Up to four times as many blades as the cutter diameter.
Super® Adjustable REAMERS	15/16" to 6" in diameter.
Wizard® QUICK CHANGE CHUCKS	Change drilling tools without stopping the spindle.
Turret TOOL POSTS	Gives engine lathes the versatility of turret lathes.
Block Type BORING BARS	Centering V-key locks cutter block accurately and rigidly
Multiple Operation TOOLS	Combine related operations speeding production and cutting costs.

CHISELS AND CHISEL BLANKS

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

CHUCKING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co., (Single and Multiple Spindle) 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Sunstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated

Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schraders Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Collet or Split

See Collets

CHUCKS, Diaphragm

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

CHUCKS, Drill

Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear

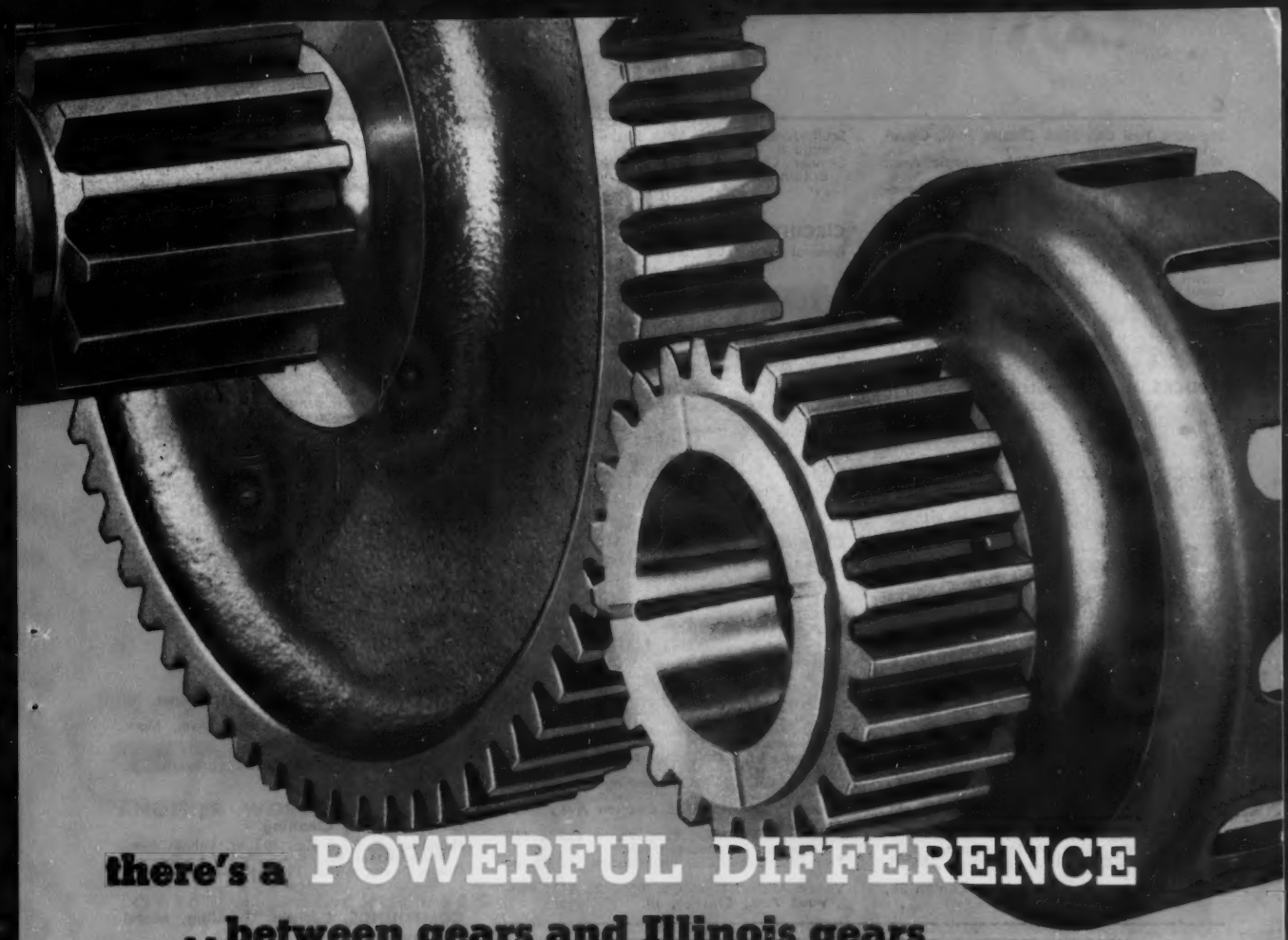
Gleason Works, 1000 University Ave., Rochester, N. Y.
Supreme Products, Inc., 2222 So. Columet, Chicago 16, Ill.

CHUCKS, Lathes, etc.

Buck Tool Co., 220 Schippers La., Kalamazoo, Mich.
Bullard Co. Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

(*Continued on page* 308)

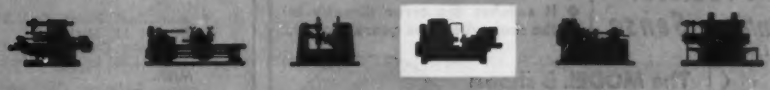
For more information on products advertised, use Inquiry Card, page 245



there's a POWERFUL DIFFERENCE

..between gears and Illinois gears

And there's a *reason* for this powerful difference . . precise quality control!



In the Illinois Gear plants, one out of every six machines is for quality control.

. . one out of every ten men is a full time quality control man.

Never will there be a compromise with quality at Illinois Gear & Machine Company . . the World's largest, most modern, best equipped gear manufacturing plants. For one gear or 10,000 or more, order from Illinois Gear.

ILLINOIS GEARS

Reg.U.S.Pat.Off.

Gears for Every Purpose ... one gear or 10,000 or more

ILLINOIS GEAR & MACHINE COMPANY

2108 NORTH NATCHEZ AVENUE • CHICAGO 35, ILLINOIS

Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated

Skinner Chuck Co., 344 Church St., New Britain, Conn.

CHUCKS, Quick Change and Safety

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel

Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CIRCUIT-BREAKERS

General Electric Co., Schenectady 5, N. Y.

CLAMPS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CLEANERS, Chemical, for Metal

Bullard Co., Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.

CLUTCHES

Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Farrell-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Formsprag Co., 23609 Hoover Rd., Van Dyke, Mich.
Link-Belt Co., 300 West Pershing Rd., Chicago 9, Ill.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine Wis.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

COLLARS, Safety

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

COMPARATORS

See Gages, Comparator.

COMPARATORS, Optical

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York.

COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lopping).
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.
Shear-Speed Chem. Prod. Div., Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

COMPOUNDS, Resin and Moulding

General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Pillipsburg, N. J.

CONTOUR FOLLOWER

Axelson Mfg. Co., P.O. Box 15335, Verona St., Los Angeles 58, Cal.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

CONTRACT WORK

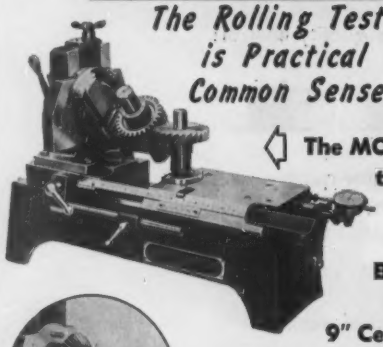
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Eisler Engrg. Co., 760 S. 13th, Newark 3, N. J.

(*Continued on page* 310)

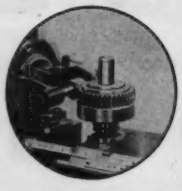
PARKSON GEAR TESTERS

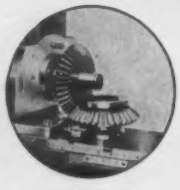
The Rolling Test is Practical Common Sense

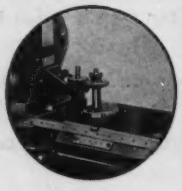
- **Indicates RUN-OUT, CENTER DISTANCE by 1/1000 vernier, BACKLASH, TOOTH JUMP, etc.**
- **It catches the error directly in the shop where the gears are cut.**

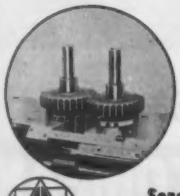


The MODEL B shown takes in SPUR WORM SPIRAL and BEVEL GEARS from 1/4" to 9" Center Distance



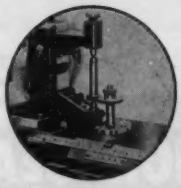






STUDY THESE PICTURES and reflect how ingeniously and simple every gear problem has been solved, including pinions with shaft, small gear 1/2" center distance, worm gears, spiral gears and even bevel gears. All without extra attachments.

NOTE that in the PARKSON the tests are being made on fixed arbors or studs avoiding rotating shafts or bearings liable to introduce errors not in the gears themselves.



Send for New Literature—Code GINSI

GEO. SCHERR CO., INC.

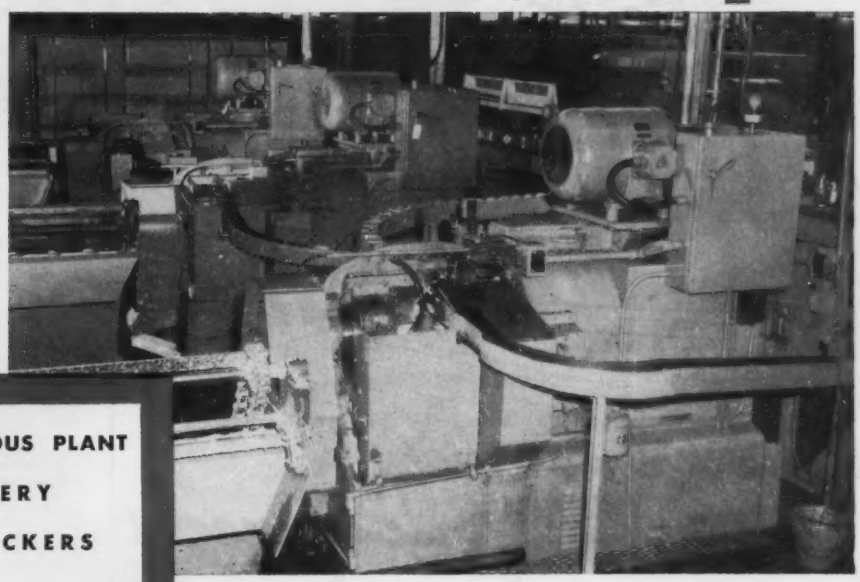
200 -MA LAFAYETTE STREET • NEW YORK 12, N. Y.

COMPLETE LINE OF PRECISION INSTRUMENTS

For more information on products advertised, use Inquiry Card, page 245

. . . IF IT'S A HIGH PRODUCTION PROBLEM . . .

ASK BAIRD ABOUT IT



ANOTHER WORLD-FAMOUS PLANT
INSTALLS BATTERY
OF BAIRD CHUCKERS

The photo above shows four of a battery of eight Baird 6-spindle automatic Chucking Machines performing the complete turning operations on aluminum alloy pistons . . . including automatic feed and discharge.

The Plant Manager says, "Previous methods of finish-turning required *four* separate operations. Now, the same results are attained in one operation . . . faster and with less chance of error." Cutting speed is 1332 to 1350 ft. per minute . . . feed per revolution .018 to .025. Actual cutting time at each station approximately 5 seconds . . . complete cycle 7.36 seconds.

Baird Chuckers are designed and built to insure positive, continuous, production . . . tooled for precision at low unit costs that give you a definite, competitive advantage.

As automation of large plants advances, Baird automatics can play a vitally important part in your production lines. And Baird engineers, highly experienced in special tooling techniques, offer you solutions for tough production problems. It will pay well to "ask Baird about it."

Write to Dept. M

THE BAIRD MACHINE COMPANY
STRATFORD CONNECTICUT

WHERE YOU WILL GET THE HELP OF SPECIALISTS ON THESE ESSENTIAL PRODUCTION PROBLEMS:

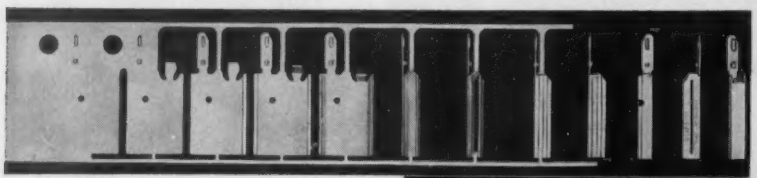
AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & STRIP METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

68A54

Why PRODUCTION B. Jahn PROVED DIES

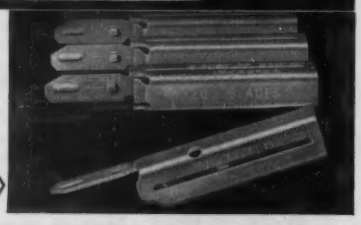
eliminate assembly problems for Engineers

The anxiety of the engineer is eliminated when B. Jahn builds dies! B. Jahn can construct a die for a single component or a number of progressive dies for complete assemblies — and submit 10 to 50,000 units for inspection and actual assembly line use. All tooling and production problems are therefore solved before the die is certified "production proved" and shipped — and the progressive engineer is guaranteed a die that will run in his equipment to his complete satisfaction.



Die ribbon for Eversharp-Schick Injector Razor Blade Holders being "production proved" — performance: 58 units per minute; precision: to micro-tolerances.

Some of 50,000 complete units submitted for manufacturer's gaging & approval before die was shipped.



Yours on request — the graphic "Story of B. Jahn Production Proved Dies."

B. Jahn

THE B. JAHN MANUFACTURING COMPANY • NEW BRITAIN, CONNECTICUT

Fellows Gear Shaper Co., Springfield, Vt.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hartford Special Machry. Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Minster Machine Co., Minster, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 250 Kishwaukee St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

CONTROLLERS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee.
Clark Controller Co., Cleveland, Ohio.
General Electric Co., Schenectady 5, N. Y.
General Radio Co., 275 Massachusetts Ave., Cambridge, Mass.

CONTROLS, Thermo

Control Products, Inc., 306 Sussex St., Harrison, N. J.

CONVEYORS FOR DUST, CHIPS, ETC.

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9.

COOLANT SEPARATORS

See Separators, Oil or Coolant.

COUNTERBORES

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Starrett, The L. S., Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

COUNTERSHAFTS

Standard Pressed Steel Co., Jenkintown, Pa.

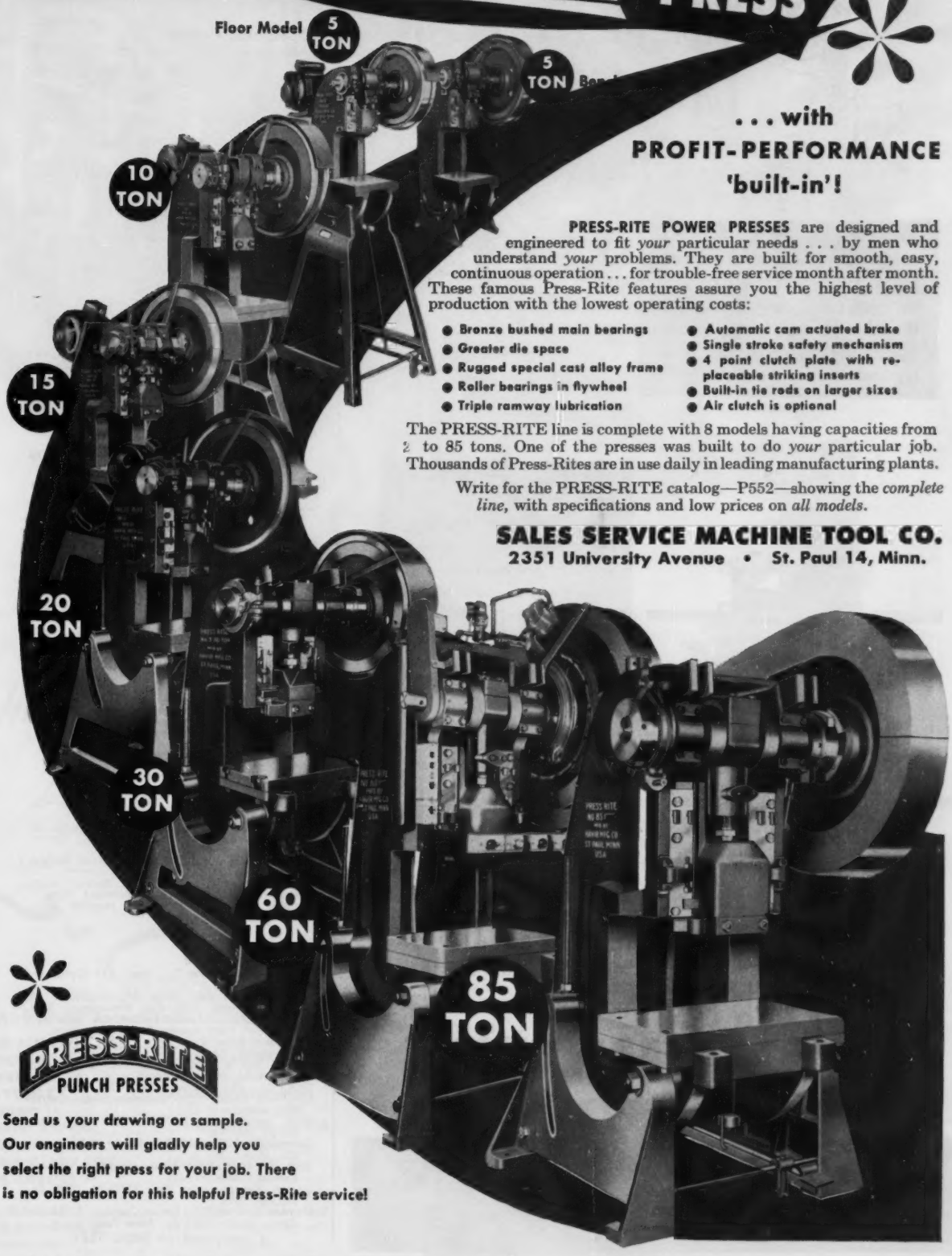
COUNTERSINKS

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp. Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.

(*Continued on page* 312)

For more information on products advertised, use Inquiry Card, page 245

SELECT THE RIGHT PRESS



. . . with PROFIT-PERFORMANCE 'built-in'!

PRESS-RITE POWER PRESSES are designed and engineered to fit *your* particular needs . . . by men who understand *your* problems. They are built for smooth, easy, continuous operation . . . for trouble-free service month after month. These famous Press-Rite features assure you the highest level of production with the lowest operating costs:

- Bronze bushed main bearings
- Greater die space
- Rugged special cast alloy frame
- Roller bearings in flywheel
- Triple ramway lubrication
- Automatic cam actuated brake
- Single stroke safety mechanism
- 4 point clutch plate with replaceable striking inserts
- Built-in tie rods on larger sizes
- Air clutch is optional

The PRESS-RITE line is complete with 8 models having capacities from ½ to 85 tons. One of the presses was built to do *your* particular job. Thousands of Press-Rites are in use daily in leading manufacturing plants.

Write for the PRESS-RITE catalog—P552—showing the *complete line*, with specifications and low prices on *all models*.

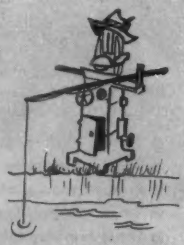
SALES SERVICE MACHINE TOOL CO.
2351 University Avenue • St. Paul 14, Minn.

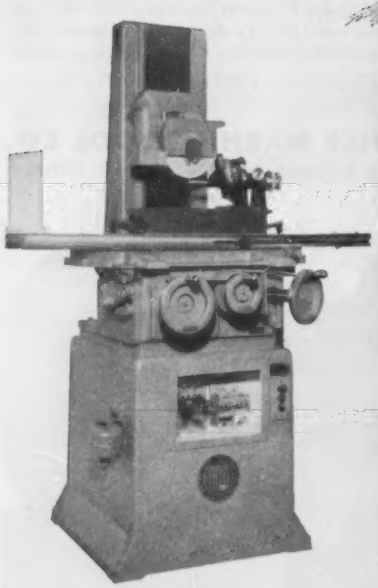
PRESS-RITE PUNCH PRESSES

Send us your drawing or sample. Our engineers will gladly help you select the right press for your job. There is no obligation for this helpful Press-Rite service!

"How about a RETIREMENT PLAN for OVER-AGE Grinders?"

Actually it's a sensible idea! For recent surveys show that ONE out of every FIVE grinders now in operation is eligible for retirement, being incapable of meeting today's precision tooling standards.





Rather than pay a heavy premium in efficiency and profits, modern management finds that it makes sense to put over-age machines out to pasture, replacing them with REID Surface Grinders . . . for REID Grinders are famed as precision Grinders, preferred by industry for dependable accuracy

Your REID Dealer will show you how easy and economical it is to replace over-age Grinders with modern, efficient, REID Precision Surface Grinders.

PLAN NOW FOR REPLACEMENT

with REID GRINDERS

For the complete story on Reid Surface Grinders please write for Bulletin 618-2.

Reid Brothers Company, Inc.

BEVERLY, MASSACHUSETTS

COUNTERS, Revolution
Brown & Sharpe Mfg. Co., Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Starrett, The L. S., Co., Athol, Mass.

COUNTING DEVICES
Starrett, The L. S., Co., Athol, Mass.

COUPLINGS, Flexible
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrell-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.

COUPLINGS, Shaft
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Sier-Bath & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Electric Traveling
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Morgan Engrg. Co., Alliance, Ohio.

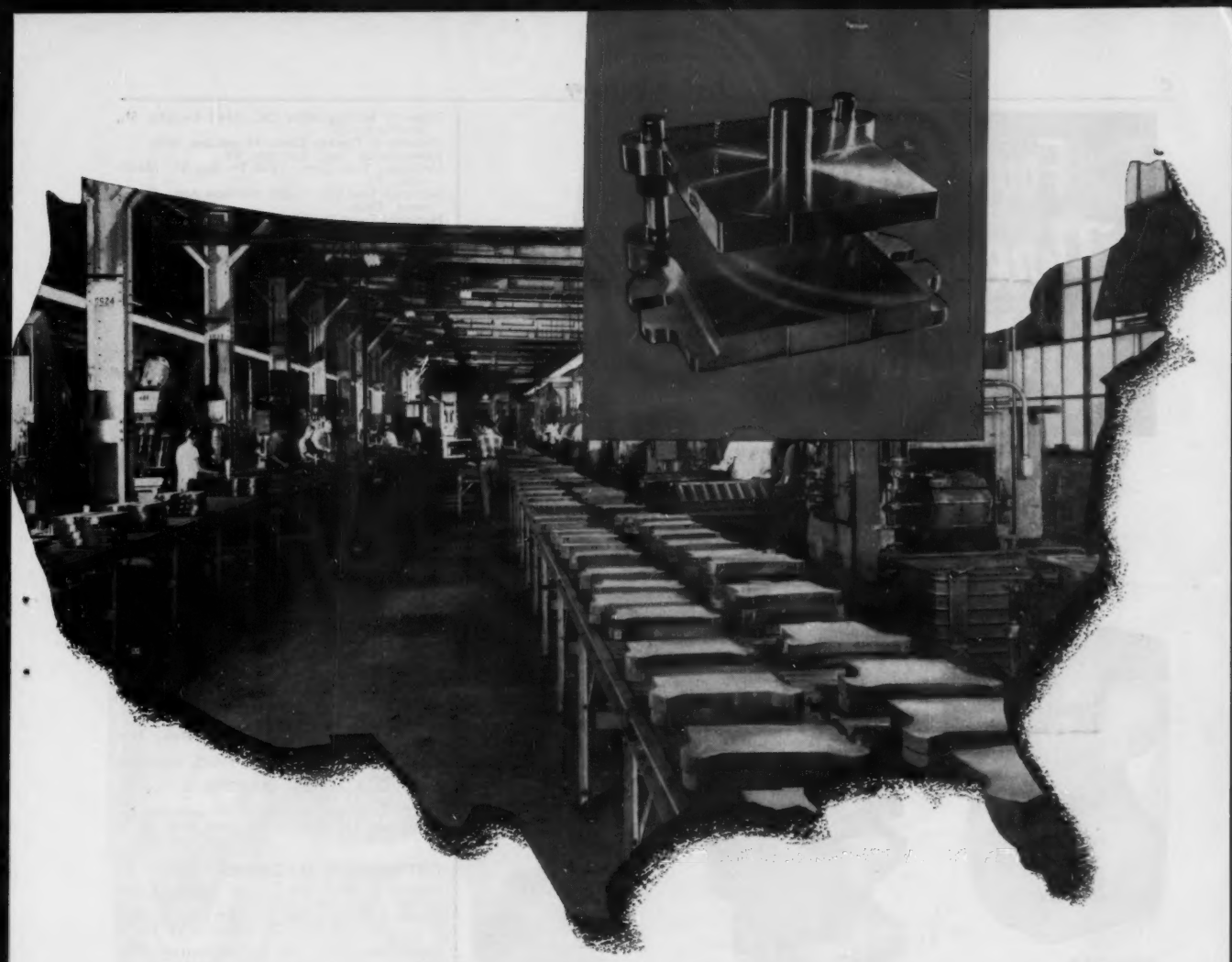
CUTTER GRINDERS
See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.

CUTTERS, Gear
Brown & Sharpe Mfg., Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St., Jean Ave., Detroit 2, Mich. (Shaving).
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Keyseater
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Eelctric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich. (Thread)
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 1440 Woodrow Wilson, Detroit, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

(*Continued on page* 314)



Here's the "how" of the fastest Die Set Service ever

FIRST, Danly is able to apply mass-production efficiency in manufacturing high precision, *interchangeable* die set components to the traditional Danly quality standards. **SECOND,** each Danly Branch is stocked with thousands of these *interchangeable* die set components, for immediate assembly to meet your tooling requirements. **THIRD,** Danly Branches are strategically located throughout the United States in major toolmaking centers to give you quick, local delivery. So, when you want the finest die sets in the shortest time . . . just call your nearby Danly Branch.

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2100 South Laramie Avenue, Chicago 50, Ill.

Which Danly Branch is closest to you?

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DETROIT 16	1549 Temple Avenue
GRAND RAPIDS	113 Michigan Street, N.W.
INDIANAPOLIS 4	5 West 10th Street
LONG ISLAND CITY 1	47-28 37th Street
LOS ANGELES 54	Ducommun Metals & Supply Co., 4890 South Alameda
MILWAUKEE 2	111 E. Wisconsin Avenue
PHILADELPHIA 40	511 W. Courtland Street
ROCHESTER 6	33 Rutter Street
ST. LOUIS 8, Mo.	3740 Washington Blvd.
SYRACUSE 4	2005 West Genesee Street

DANLY

DIE SETS . . .
STANDARD OR SPECIAL
DIEMAKERS' SUPPLIES

Four Standard Thread Rolling Attachments

REED RID CO

For more than 100 sizes of machines

For more than 300 cross slide applications

Select the one you need...

Operating from the cross slides of automatic screw machines, each size of attachment is adjustable to accommodate an infinite range of work diameters within its capacity. Maximum thread rolling capacity within the tooling sector of over 100 sizes of single and multiple spindle automatic screw machines is possible through the selection of one of the four standard attachments. A large assortment of adapters are available that permit more than 300 cross slide applications.

Send us specifications of your requirements and let us supply you with complete information.

REED ROLLED THREAD DIE CO.

THREAD ROLLING MACHINES and DIES • KNURLS • THREAD ROLLS
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Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

688

Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Willey's Carbide Tool Co., 1340 W. Verner Hwy., Detroit 1, Mich.

CUTTERS, Rotary

See Files & Burrs, Rotary

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, Etc.

CUTTING AND GRINDING FLUIDS

Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cimcool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Shear-Speed Chemical Products, Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Johnson Mfg. Co., Albion, Mich.
Landis Machine Co., Waynesboro, Pa., (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).

CUTTING-OFF MACHINES, Abrasive Wheel

Allison Co., Bridgeport, Conn.
Campbell Mch. Div., American Chain & Cable 929 Conn. Ave., Bridgeport, Conn.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614 G. N. Lexington Ave., Pittsburgh 8, Pa.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.

CUTTING-OFF MACHINES, Cold Saw

See Sewing Machines, Circular

CUTTING-OFF MACHINES, Metal Band Saws

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Grob, Inc., Grafton, Wis.

CUTTING-OFF TOOLS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

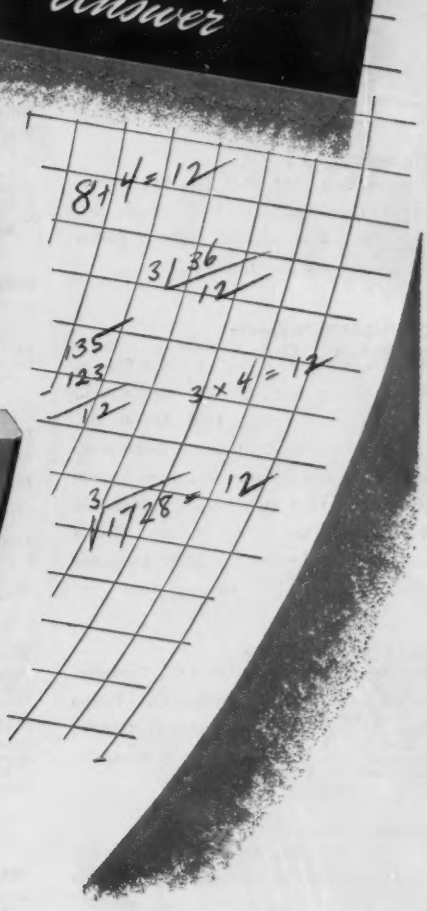
(*Continued on page* 316)

For more information on products advertised, use Inquiry Card, page 245

Any way you figure it

NORMA-HOFFMANN PRECISION BEARINGS

are the Right Answer



NORMA-HOFFMANN BALL BEARINGS

Rugged—thoroughly dependable for carrying thrust and radial loads.

NORMA-HOFFMANN ROLLER BEARINGS

Short, cylindrical roller design . . . heavy-duty bronze retainer . . . lowest possible co-efficient of friction under heavy load.

Norma-Hoffmann heavy-duty Bearings improve the design and performance of products wherever they are used. They are dependable, give friction-free smoothness and quietness of operation. Available in a wide range of sizes for every load, speed and duty. Write for catalog and engineering assistance.

NORMA-HOFFMANN
Precision **BEARINGS**
BALL • ROLLER • THRUST

NORMA-HOFFMANN BEARINGS CORPORATION
STAMFORD, CONNECTICUT—Founded in 1911
FIELD OFFICES: Chicago, Cincinnati, Cleveland, Dallas, Detroit, Kansas City, Los Angeles, San Francisco, Seattle

For more information on products advertised, use Inquiry Card, page 245

Kennametal, Inc., Latrobe, Pa.
Luers, J. Milton, 12 Pine St., Mt. Clemens, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CUTTING-OFF WHEELS, Abrasive

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

CYLINDER BORING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

CYLINDERS, Air

Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Barnes, John S., Corp., Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg., Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co. Inc., 810 Center Ave., Logansport, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.

DEALERS, Machinery

Falk Machinery Co., 18 Ward St., Rochester, N. Y.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Inc., Worcester, Mass.

DESIGNERS, Machine and Tool

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Hartford Specialty Mchry. Co., 287 Homestead St., Hartford, Conn.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DIAMONDS AND DIAMOND TOOLS

Smit, J. K., & Sons, Inc., Murray Hill, N. J.

DIE-CASTING

See Castings, Die

DIE-CASTING MACHINES

Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.

DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DIEMAKERS' SUPPLIES

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DIEMAKING MACHINES

Grob, Inc., Grafton, Wis.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Moumee St., Adrian, Mich.

DIE SETS, Standard

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danley Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

DIE-SINKING MACHINES

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Gorton, George, Machine Co., 1110 W. 13th St. Racine, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.

DIE-SINKING PRESSES

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

DIE STOCKS

See Stocks, Die

DIES, Sheet Metal, Etc.

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Carboloy Dept. General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krupp Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
John B., Manufacturing Co., Ellis St., New Britain, Conn.
Metal Carbides Corp., Youngstown, Ohio.
Niagara Mch. & Tool Wks. 683 Northland Ave., Buffalo, N. Y.
Richard Bros., Div., Allied Products Corp., 12619 Burt Rd., Detroit 23, Mich.
Taft-Pierce Mfg. Co., Woonsocket, R. I.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Waltham Mch. Wks., Newton St., Waltham, Mass.

DIES, Threading

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg., Mansfield, Mass.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

DIES, Threading, Opening

Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Geometric Tool Co., Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

DIES, Thread Rolling

Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

DISCS, Abrasives

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.
Walls Sales Corp., 333 Nassau Ave. Brooklyn 22, N. Y.

DISINTEGRATORS

Elox Corp., 602 N. Rochester Rd., Clawson, Mich.

DIVIDING HEADS

See Indexing and Spacing Equipment

DOYELL PINS

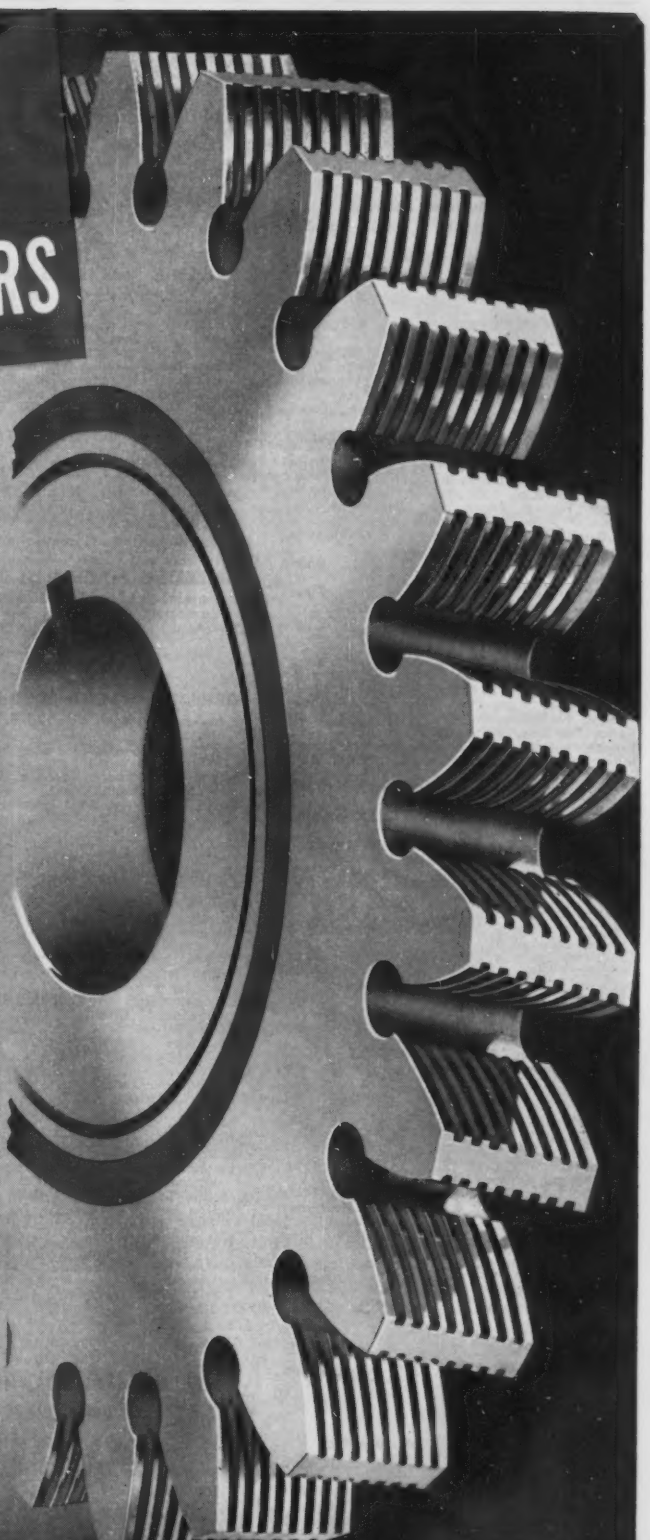
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRESSERS, Grinding Wheel

Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Carbides Corp., Youngstown, Ohio.
Meyers, W. F. Co., Bedford, Ind.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.

(*Continued on page* 318)

CHECK LIST FOR BUYERS OF SHAVING CUTTERS



Knowing the absolute necessity for QUALITY in your gear shaving cutters, you might consider these points the next time you order.

1. **How much experience does the cutter manufacturer have?**

   Since 1932 when National Broach built the first Rotary Gear Shaving Machine, this company has always been the largest producer of shaving cutters.

2. **Has the cutter manufacturer a staff of engineer specialists who concentrate exclusively on cutter design?**

   National Broach has such a staff.

3. **Does the cutter manufacturer heat treat his own tools and is his grinding department temperature controlled?**

   Every Red Ring Cutter is heat treated and controlled by Red Ring metallurgists and ground on special Red Ring grinders under precise temperature control.

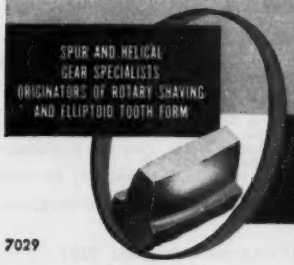
4. **Does the cutter manufacturer prove every cutter design by actual try-out in his own plant before it is released?**

   No new Red Ring cutter design is ever released otherwise.

5. **Is the cutter manufacturer prepared to assist you in cutter development — involute modification, etc. when needed?**

   National Broach has always maintained such a service for you.

For further information, write for Chapter 2, Modern Methods of Gear Manufacture.



NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

7029

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Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL HEADS, Multiple Spindle

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Etto Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Keller Tool Co., Grand Haven, Mich.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-H Harriet St., Cincinnati 3, Ohio.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

DRILL SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STANDS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STOPS

Wohlnip Engineering Co., 390 Hillside Ave., Hillside, N. J.

DRILLING MACHINES, Automatic

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros. Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Bench

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Buffalo Forge Co., 490 Broadway, Buffalo.
Conedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Walker-Turner Div., Kearney & Treckar Corp., 900 North Ave., Plainfield, N. J.

DRILLLING MACHINES, BOILER

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.

DRILLING MACHINES, Deep Hole

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.

DRILLING MACHINES, Gang

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

DRILLING MACHINES, Horiz. Duplex

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill

DRILLING MACHINES, Horizontal Portable

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

DRILLING MACHINES, Inverted

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

DRILLING MACHINES, Multiple Center Column Type

Avey Drilling Mch., Co., 26 E. Third St., Covington, Ky.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

DRILLING MACHINES, Multiple Spindle

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St. Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hartford Special Mchry, Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Snow Mfg Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

(*Continued on page* 320)

Are you BARRED

from planned assembly savings

BY A THREAD?

Screws can be "trouble-bent" in many ways. Most thread faults like those listed here are invisible, but their effects (job slowdown, parts spoilage, high reclamation expense, hidden weakness) show clearly in assembly costs and customer complaints.

That's why P-K quality standards have been set so high—to make sure you get Self-tapping Screws that are not only threaded, but headed, pointed and heat-treated with one purpose in mind, to keep your assembly lines trouble-free.

For information on any fastening problem, talk to a P-K Assembly Engineer. Parker-Kalon Division, General American Transportation Corporation, 202 Varick St., New York 14. Chicago Warehouse, 4331 West Lake St., Chicago 24.

IS DIAMETER OFF-SIZE?
— means hard driving
— breakage
— weak fastenings
DO THREADS STOP SHORT OF HEAD?
— means loose screws
ARE THREADS RAGGED and SEAMED?
— makes driving difficult
ARE THREADS TOO SOFT?
— means spalled threads
ARE THREADS TOO HARD?
— means stripped threads
IS POINT (on Sheet Metal Screws) BLUNT?
— makes starting difficult

P-K STANDARDS PROTECT you against the thread faults illustrated and many others that will cause assembly trouble and weak fastenings. They don't "get by" P-K inspectors—that's why *all* P-K Self-tapping Screws can be "Guaranteed First Quality."

EASTMAN KODAK speeds up assembly of the Kodalite Flashholder by using P-K Self-tapping Screws. Troublesome tapping of small holes in plastic was eliminated. Screws are driven with hopper-fed automatic machines, removing necessity for tedious screw handling and placement. Two P-K Phillips Head Type F Screws fasten a cover mounting bracket to the flashholder case (right) and three more fasten the metalized Tenite II reflector to the case (left). Case is a thermo-setting phenolic. Screws hold firmly under all stresses of normal use, can be removed for attachment of new reflector.

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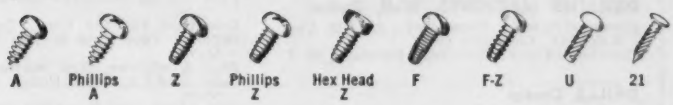
The First SELF-TAPPING SCREWS



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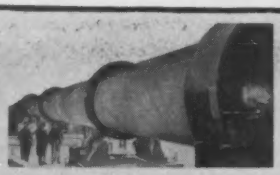

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DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foot-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kaukauna Machine Corp., Kaukauna, Wis.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLING MACHINES, Rail

See Drilling Machines, Gang

DRILLING MACHINES, Sensitive

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foot-Burt Co., 1300 St. Clair Ave., Cleveland, 8, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

DRILLING MACHINES, Upright

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

DRILLING MACHINES, Wall, Radial

Cleveland Punch & Shear Works, 3817 St. Clair Ave., N.E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

DRILLS Center

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Keo Cutters, 19326 Woodward, Detroit, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core

Corboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
McGrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DRILLS, Deep Hole

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

Black & Decker Mfg. Co., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
Ryerson Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

DRILLS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St. New York 9, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLS, Rachet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, SPADE

Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.

DRILLS, Twist

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
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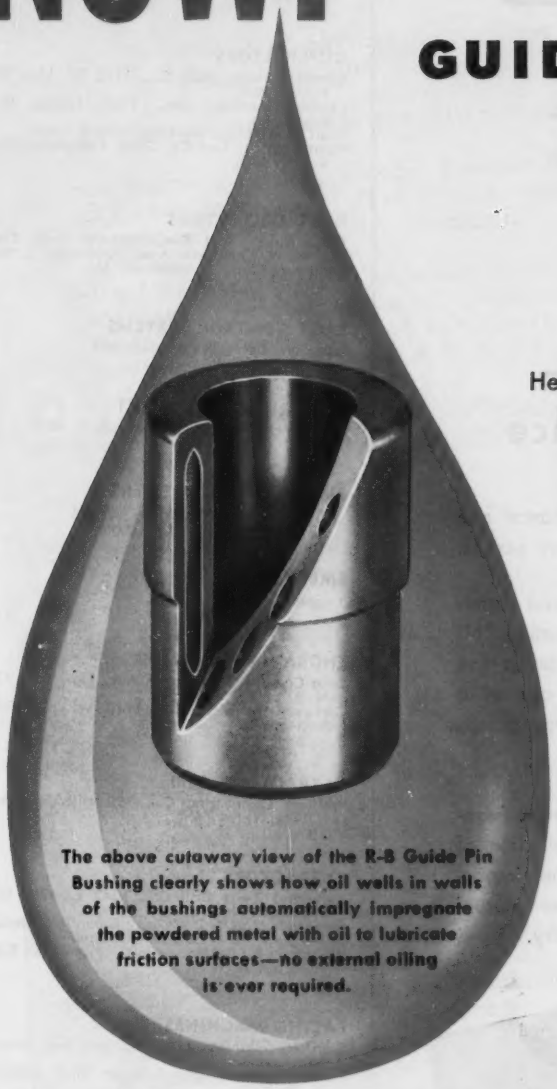
(*Continued on page 322*)

NOW! *Self-Oiling*

GUIDE PIN BUSHINGS OF POWDERED ALLOY STEEL



The above cutaway view of the R-B Guide Pin Bushing clearly shows how oil wells in walls of the bushings automatically impregnate the powdered metal with oil to lubricate friction surfaces—no external oiling is ever required.

Here's an entirely new concept in guide pin bushings—made of heat treated powdered alloy steel, each bushing has filled internal oil wells. Lubrication to friction surfaces is automatic and no external oiling is required throughout the long life of the bushings.

Wear characteristics of these bushings are comparable to that obtained with finest bronze bushings. In addition, this new R-B design greatly reduces guide pin wear and the possibility of seizing or galling. Self-oiling, less guide pin wear and longer life add up to minimum maintenance, reduced costs and maximum usage of press time.

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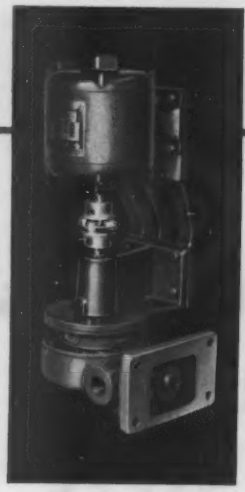

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Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRIVES, Chain
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

DUPLICATORS
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Richford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

DUST COLLECTORS
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Pangborn Corp., Hagerstown, Md.

DUST CONTROL SYSTEMS
Pangborn Corp., Hagerstown, Md.

ELECTRICAL EQUIPMENT
General Electric Co., Schenectady 5, N. Y.

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EMERY WHEELS
See Grinding Wheels

ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.

EXTRACTORS, Drill
Wohlnip Engineering Co., 390 Hillside Ave., Hillside, N. J.

EXTRACTORS, Screw
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

FACING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.

FANS, Exhaust, Electric Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
General Electric Co., Schenectady 5, N. Y.

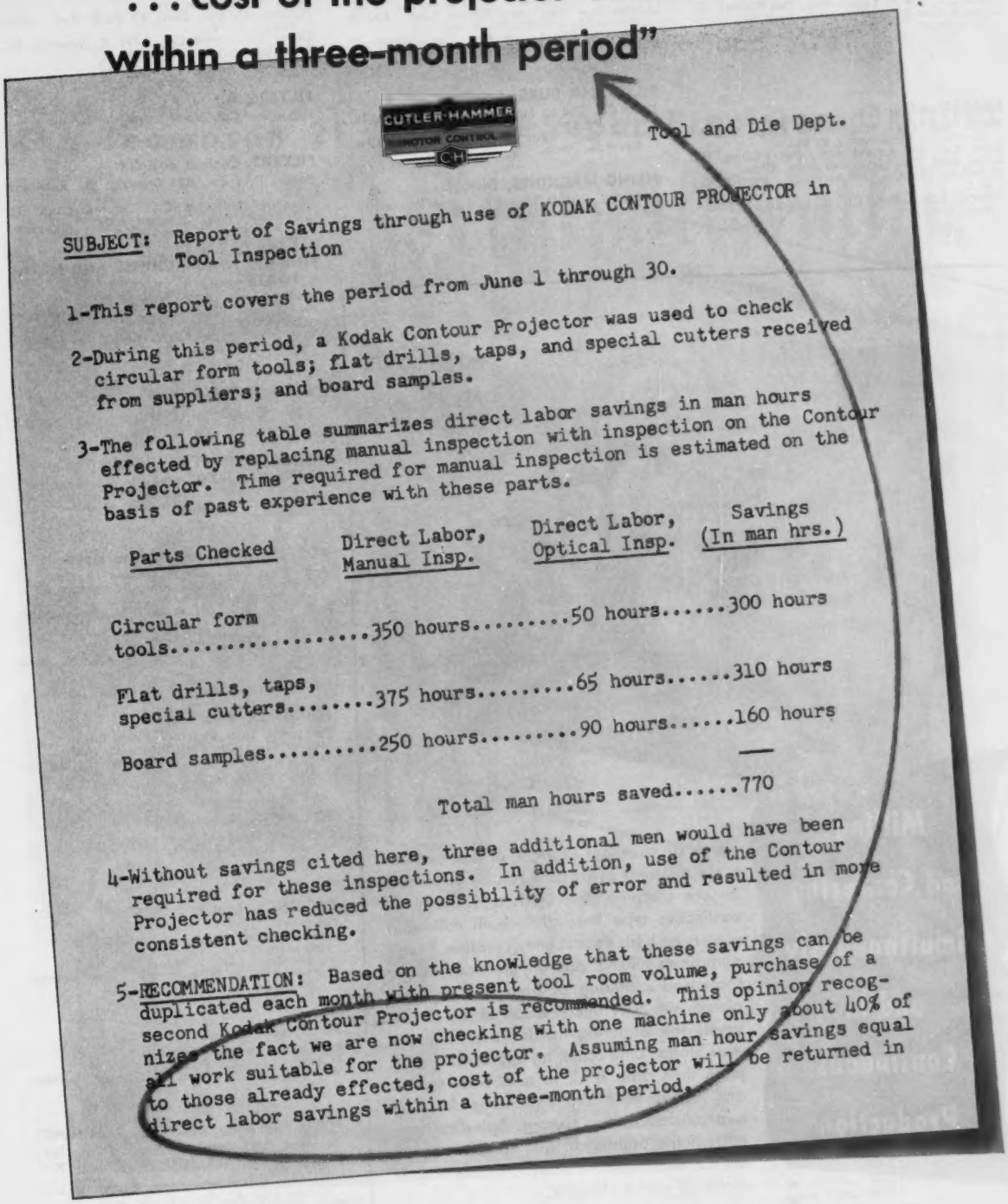
FEEDS FOR PRESSES, Automatic
Federal Press Co., 600 Division and Big Four R. R. Elkhart, Ind.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FELT, For All Applications
American Felt Co., Glenville, Conn.

(*Continued on page* 324)

For more information on products advertised, use Inquiry Card, page 245

"...cost of the projector will be returned within a three-month period"



CUTLER-HAMMER MOTOR CONTROL CH

Tool and Die Dept.

SUBJECT: Report of Savings through use of KODAK CONTOUR PROJECTOR in Tool Inspection

1-This report covers the period from June 1 through 30.

2-During this period, a Kodak Contour Projector was used to check circular form tools; flat drills, taps, and special cutters received from suppliers; and board samples.

3-The following table summarizes direct labor savings in man hours effected by replacing manual inspection with inspection on the Contour Projector. Time required for manual inspection is estimated on the basis of past experience with these parts.

Parts Checked	Direct Labor, Manual Insp.	Direct Labor, Optical Insp.	Savings (In man hrs.)
Circular form tools	350 hours	50 hours	300 hours
Flat drills, taps, special cutters	375 hours	65 hours	310 hours
Board samples	250 hours	90 hours	160 hours
		Total man hours saved	770

4-Without savings cited here, three additional men would have been required for these inspections. In addition, use of the Contour Projector has reduced the possibility of error and resulted in more consistent checking.

5-RECOMMENDATION: Based on the knowledge that these savings can be duplicated each month with present tool room volume, purchase of a second Kodak Contour Projector is recommended. This opinion recognizes the fact we are now checking with one machine only about 40% of all work suitable for the projector. Assuming man hour savings equal to those already effected, cost of the projector will be returned in direct labor savings within a three-month period.

Such reports by users of the Kodak Contour Projector are typical. To find out more about how optical gaging speeds inspection, improves accuracy, write for a copy of the illustrated booklet "The Kodak Contour Projector."

EASTMAN KODAK COMPANY, Special Products Sales Division, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak

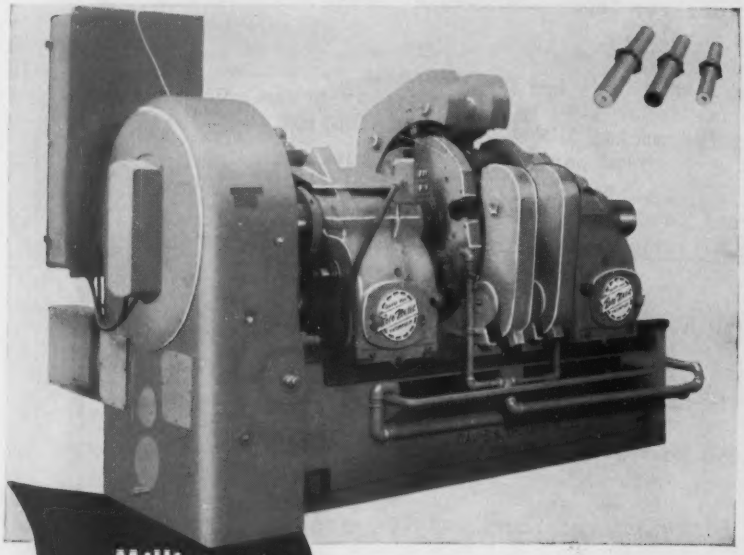
FILES, Hack
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Hand
Atkins Saw Div., Borg-Warner Corp., 402 S. Illinois St., Indianapolis 9, Ind.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Heller Bros. Co., Newcomerstown, Ohio.
Nicholson File Co., 23 Acorn St., Providence, R. I.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Machine
Atkins Saw Div., Borg-Warner Corp., 402 S. Illinois St., Indianapolis 9, Ind.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILES AND BURS, Rotary
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES, Dies, Etc.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Germanow Simon Mch. Co., 388 St. Paul St., Rochester, N. Y.



Milling and Centering Simultaneously and in Continuous Production

Here's an excellent example of how two entirely different operations can be combined on one machine. This Davis and Thompson continuous type Roto-Matic both mills and centers on both ends in one operation. Rough and finish milling cuts on the ends of the shaft and centering of both ends is completed with only one rotation of the fixture drum. The centering heads travel with the work station until centering operation is complete then drop back to next work station and repeat. Automatic equalizing clamping is provided to the fixture. Spindles have micrometric adjustment and spindle carriers are adjustable on the ways to accommodate shafts of various lengths.

FREE DATA on this and other Davis and Thompson machines is available in our bulletin No. 1000.

Roto-Matic

Davis and Thompson Co.

4460 N. 124th ST. MILWAUKEE 16, WISCONSIN

FILTERS, Air
Keller Tool Co., Grand Haven, Mich.

FILTERS, Coolant and Oil
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Industrial Filtration Co. (Delpark Corp.) 15 Industrial Ave., Lebanon, Ind.

FINISHES FOR MACHINES AND METAL PARTS
Lowe Bros. Co., Dayton, Ohio.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.
Ransburg Electro-Coating Corp., 1234 Barth, Indianapolis, Ind.

FLEXIBLE COUPLINGS
See Couplings, Flexible

FLEXIBLE SHAFT EQUIPMENT
Pratt & Whitney West Hartford 1, Conn.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

FORGINGS, (Upsetting) Machines
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

FORGINGS, Drop
Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow Bored
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel
Bethlehem Steel Co., Bethlehem, Pa.
Cameron Iron Works, Inc., 1000 Silber Rd., Houston, Texas.
Morgan Engrg. Co., Alliance, Ohio.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Upset
Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING AND BENDING MACHINES
American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

(*Continued on page* 326)

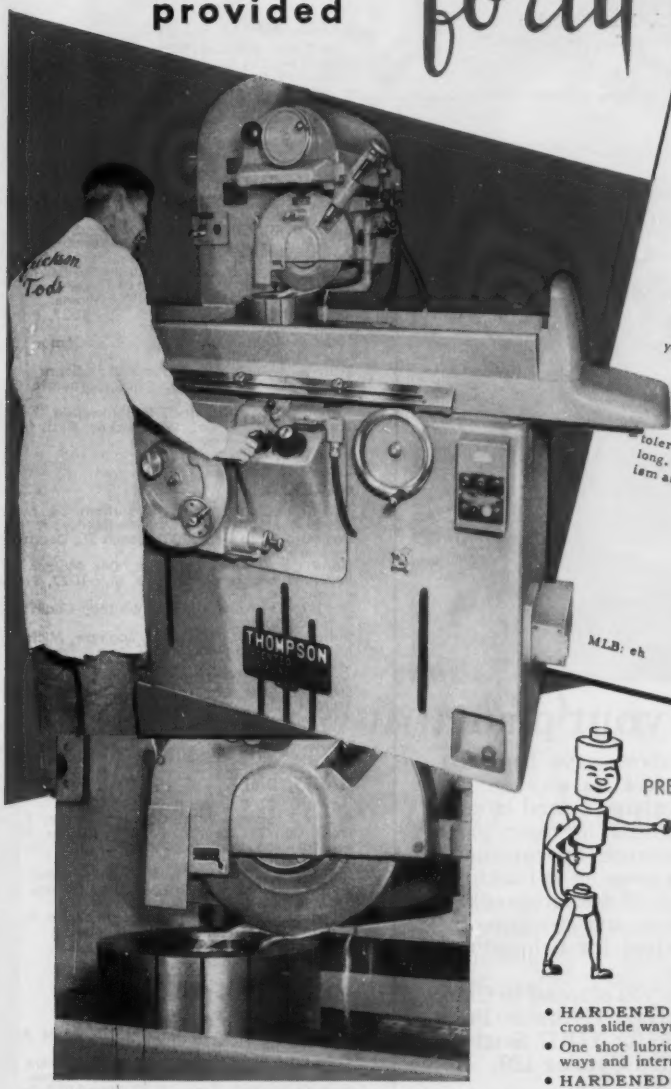
Grob, Inc., Grafton, Wis.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

The Erickson Tool Company

asked for at least .0001 for parallelism and size. . .

The Thompson 2F (8x10x24) Super Precision Grinder

provided "forty millionths"



ERICKSON TOOL COMPANY
EAST 330 AND HAMILTON AVENUE
CLEVELAND 14, OHIO

September 17, 1954

The Thompson Grinder Company
Springfield, Ohio

Attention: Mr. John Wilson,
Vice President.

Gentlemen:

May we take this opportunity to express our satisfaction with your Thompson 2F 8 x 10 x 24 Surface Grinder.

We purchased this grinder on your claim of .0001 for parallelism size. This tolerance is necessary for most of our work.

Upon its arrival we asked a service man to prove this .0001 tolerance, using 5 blocks on a surface of 4 inches wide by 20 inches long. The test blocks showed .00004 (forty millionths) for parallelism and size. This was well within your guarantee.

Yours truly,

ERICKSON TOOL COMPANY

M. L. Benjamin,
President.

MLB: eh

PRECISION PETE says:

"You may be surprised to find that Thompson 2F Grinders cost less than some others and still provide all these features for greater accuracy and longer service. Fast delivery, too!"

"Erickson products are sold and guaranteed to hold extreme accuracy. It is vital that we have the precision equipment necessary to manufacture these products. Our Thompson 2F Grinder delivers this precision. In the above picture we are grinding a #1200 expanding sleeve and hold within .0001 parallelism and size."

- **HARDENED AND GROUND** cross slide ways completely sealed.
- One shot lubrication to cross slide ways and internal saddle bearings.
- **HARDENED AND GROUND** sealed anti-friction vertical slide.
- **HARDENED AND GROUND BED WAYS** with automatic lubrication.
- 3600/1800 R.P.M. 2 speed wheel head. Heavy alloy steel spindle heat treated, runs in super precision ball bearings accurately preloaded, lifetime lubricated.
- Handy control panel.
- Elevation micrometer stop graduated in .0001"
- **GROUND THREAD FEED SCREW.**
- Automatic wheel **TRUING** device.
- Longitudinal hand feed with automatic engagement.
- Hydraulic head movement throttle with rapid traverse.
- Hydraulic table movement throttle.
- Elevating hand wheel graduated in .0005".

Call, write or wire for estimate

Thompson Grinders

THE THOMPSON GRINDER COMPANY • SPRINGFIELD, OHIO

FORMING AND STAMPING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

FORMING TOOLS or Tool Blanks

Brown & Sharpe Mfg. Co., Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FRAMES, Machinery Welded

Mahan, R. H. Co., Detroit 34, Mich.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

FURNACES, Heat-Treating

General Electric Co., Schenectady 5, N. Y.

FURNITURE, Shop

Standard Pressed Steel Co., Jenkintown, Pa.

GAGE BLOCKS

Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

GAGES, Air

Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Comparator

Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Ames, B. C., Co., Waltham 54, Mass.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Depth

Ames, B. C., Co., (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Dial

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co. Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Electric

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027 Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.

GAGES, Height

Amco Gage Co., 19760 W. 8 Mile Rd. Detroit 19, Mich.
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

(*Continued on page* 330)

With a Dake Press, lift truck tires can be changed right in your plant

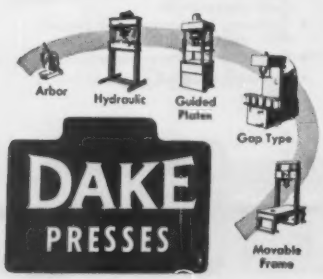
No need to carry an inventory of spare lift truck wheels in different diameters and widths! With a Dake Hydraulic Press you need only tires and rims which can be pressed on and off in your own plant.

This not only means lower investment and reduced service time, but it brings additional savings from being able to buy tires direct from a mill supplier.

The Dake customer pictured above says his Dake Press pays its way on tire service alone . . . and he uses it in addition for many plant maintenance operations — such as pressing in bushings, pressing off frozen sprockets and gears, and straightening plate steel for briquetting presses.

Have you stopped to think what a Dake Hydraulic Press could do for YOU? Send for illustrated Catalog 129.

Dake Engine Company, 604 Seventh St., Grand Haven, Mich.



Send for Big New Catalog

DAKE ENGINE COMPANY
604 Seventh St., Grand Haven, Mich.

Please send me a copy of Dake Catalog No. 129

Name_____

Company_____

Address_____

City_____ Zone____ State_____

For more information on products advertised, use Inquiry Card, page 245

ONE OF A SERIES

You Get Many Benefits
by Specifying VICKERS Hydraulics

Hydraulics School for Customers' Own Service and Maintenance Men

Manufacturers who have Vickers Hydraulic Equipment on their machines can have their own service men trained in the Vickers Hydraulics School. Since its beginning in 1945, this school has trained more than 1115 men from approximately 642 companies. There is no tuition charge for this training course.

These men are given a thorough schooling in hydraulic theory and practice . . . and in the operation and maintenance of Vickers Hydraulic Equipment. The benefits to manufacturers of Vickers-equipped machines are obvious. Of equal importance are the benefits to users of such machines who are thus assured of better maintenance.

Again, this is only one of many reasons why it pays to specify Vickers Hydraulics.

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6393R

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

For more information on products advertised, use Inquiry Card, page 245

SCULLY JONES

Does five operations at with the help of Scully-

Manufactured by Michigan Drill Head Company, Detroit, Michigan, the "Hydro 20" drills, reams, chamfers, rough bores, and finish bores 13 holes at the rate of 100 pieces per hour.
Michigan

Michigan Hydro 20 "factory-equipped" with Scully-Jones Adjustable Adapters and Drill Chucks

Michigan makes sure this multiple-spindle machine operates with high precision at maximum efficiency by equipping the spindles with "Precision Holding" Tools—Scully-Jones Quick-Lock Adjustable Adapters to speed setup and tool changes, guard against spindle distortion, and provide quick depth adjustments—Scully-Jones Drill Chucks to increase accuracy and reduce tool breakage.

the rate of 100 per hour Jones "*Precision Holding*" tools

Improved four-slot design, now standard on all Scully-Jones Drill Chucks ⅛" and larger, has better seating and collet action and greater resistance to pull-out. This means less tool breakage and downtime, plus added assurance your drills will run true.
Quick-Lock Adjustable Adapters, with new "Keyhole" slot, eliminate damage often caused by hammering with conventional drift, make tool changes faster and easier.

More trouble-free production is now possible on multiple-spindle machines equipped with *improved* Scully-Jones Quick-Lock Adjustable Adapters. The new "Keyhole" slot and Ejector make tool changes faster, easier, and safer. The pilot nose minimizes any tendency of adapters to bind or jam in the spindle. Your machines are protected against misalignment and damage by these easy-operating, more accurately fitting tools. And, with quick and easy adjustments of the Quick-Lock Nut, you speed setup and accurately control cutting tool depth.

More good news! Scully-Jones Drill Chucks . . . offering increased resistance to "pull-out," improved seating, and truer collet action . . . are now available from stock. The new four-slot design gives you all the advantages of small diameter, plus added protection against tool breakage and production shutdowns.

Your factory-trained Scully-Jones representative or distributor can demonstrate these advantages to you, and explain why Scully-Jones tools hold accuracy and last longer, even under hard usage.

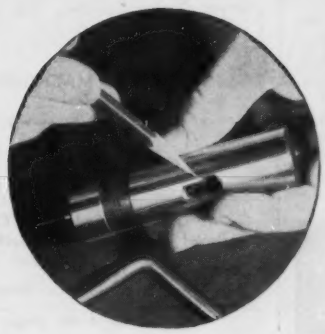
Next time you buy *or build* a machine tool, make sure it's equipped with Scully-Jones "Precision Holding" tools.

SCULLY JONES

SCULLY-JONES

"Precision Holding" for holding precision

Scully-Jones and Company, 1906 S. Rockwell Street, Chicago 8, Illinois



NEW "KEYHOLE" TOOL EJECTOR SAFEGUARDS MACHINE ACCURACY!

. . . another reason you should ask for Scully-Jones Adjustable Adapters, Sleeves and Sockets, Quick-Change Chuck Collets, Turret Tool Holders, and Counterbore Drivers, on which "Keyhole" slots are the *new standard*. Write for details in Bulletin 14-50.

GAGES, Plug, Ring and Snap

Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co. Athol Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros. Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GAGES, Surface

Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Taper

Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GASKETS

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.

GEAR BLANKS, Non-Metallic

Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
General Electric Co., Schenectady 5, N. Y.

GEAR BURNISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR CHAMFERING, ROUNDING AND BURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

GEAR CHECKING INSTRUMENTS AND EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

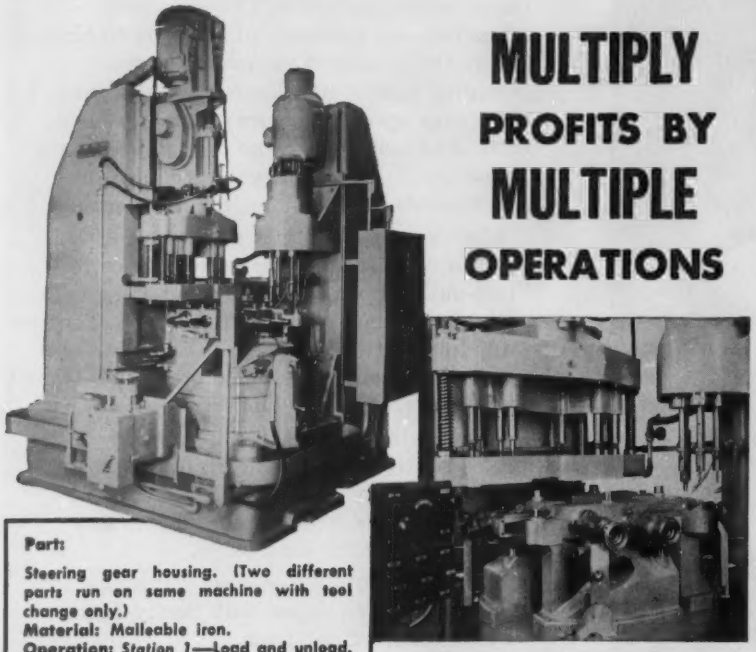
GEAR CUTTING MACHINES Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Waltham Machine Works, Newton St., Waltham, Mass.

(*Continued on page* 334)



MULTIPLY PROFITS BY MULTIPLE OPERATIONS

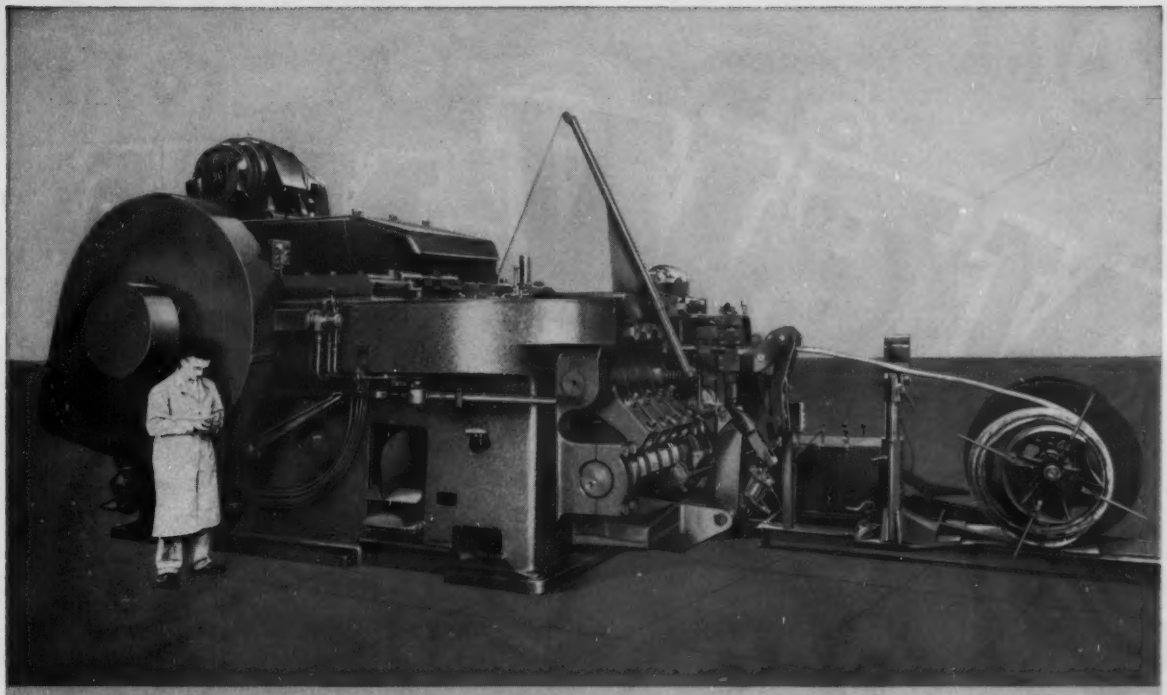
Part:
Steering gear housing. (Two different parts run on same machine with tool change only.)
Material: Malleable iron.
Operation: *Station 1*—Load and unload. *Station 2*—Drill (3) .368" holes; (1) .120" hole. *Station 3*—Combination spot face and chamfer (3) holes, drill (1) 23/32" hole for tapping. *Station 4*—Tap (3) 7/16"-14 NC-3 thread; tap 1/2"-14 NPSF thread.
Description: Millholland 4-station automatic index machine equipped with 4-station automatic index table, with 1 No. 5 Millholland Automatic Unit driven by 7-1/2 HP motor with 8-spindle ball bearing multiple head for drilling 5 holes and combination spot facing and chamfering 3 holes; 4-spindle tapper on right-hand column.
Operator loads part and pushes button initiating automatic cycle, unloads. Two parts machined at a time.

MILLHOLLAND ENGINEERED FOR MAXIMUM PRODUCTION

For special production machines, Millholland Automatic Units offer distinct advantages. These self-contained units, driven by individual motors, are readily adapted to a wide range of operations. Their full automatic cycle with interlocked controls permits several units to be grouped for simultaneous operations, or they can be mounted on other production machines and synchronized to perform additional operations. Millholland Automatic Units have proved themselves in 30 years of outstanding performance on all types of jobs. Get full details in Bulletin M-11.

W. K. MILLHOLLAND MACHINERY CO.
6402 Westfield Blvd., Indianapolis 2, Indiana

For more information on products advertised, use Inquiry Card, page 245



AUTOMATIC FORGING MACHINES!

This is the largest high-speed automatic cold-forming machine yet built, and larger ones are in the works.

Using 1-1/2-inch diameter coiled hot-rolled stock, this 200,000 pound machine, designed and built by NATIONAL, automatically produces 40 clean, accurate parts per minute!

Through the years we have teamed up with industry on many novel automatic hot and cold forging installations — for making a wide variety of fasteners, automotive and aircraft components, and other parts.

If you need to make metal parts faster, stronger and at lower cost, let us work with you. Send us your prints and samples, or better yet, visit us. No obligation.

NATIONAL
MACHINERY COMPANY
TIFFIN, OHIO—SINCE 1874

DESIGNERS AND BUILDERS OF MODERN FORGING MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS • BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS

Hartford Detroit Chicago

NEW-NEW-

BULLARD

HORIZONTAL, BORING, MILLING and DRILLING MACHINES

Model 75

with improved features for increased production and efficiency, ease of operation and maintenance, greater rigidity, flexibility and capacity.

- **PENDANT CONTROL —** Exclusive Bullard design for complete machine control from a movable pendant station. Feed and speed rate selection, directional feed and traverse engagement of the spindle, head, table and saddle, spindle rotation and operation of head binders are accomplished from the Pendant. Interlocks and a stop-all stick provide safety for both operator and machine.
- **SCREW AND RACK FEEDS —** to the spindle provides smooth, steady screw feed for boring and sensitive hand feed for small drilling and tapping.
- **THE HEAD, HEADPOST AND REAR POST** are solidly built for maximum rigidity providing a higher degree of maintained accuracy under all operating conditions.
- **OPTICAL MEASURING EQUIPMENT** for head and table (optional).

NEW NEW

Available in 3, 4 and 5 inch spindle sizes, the Bullard Horizontal Boring, Milling and Drilling Machine, Model 75, is engineered to meet industry's present-day and future production requirements as it embodies the most modern machine design principles and techniques.

For the complete story use this coupon for your copy of the new catalog.

THE BULLARD COMPANY

286 Canfield Avenue • Bridgeport 2, Connecticut

Please send me a copy of the new Bullard Horizontal Boring, Milling and Drilling Machine, Model 75, Catalog today.

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COMPANY..... POSITION.....

ADDRESS.....

CITY..... ZONE..... STATE.....

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Barber-Colman Co., Rock and Montague, Rockford, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt. (Straight and Hourglass Types).
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR FINISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR GRINDING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., Springfield, Mass.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR MOTORS

See Speed Reducers.

GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

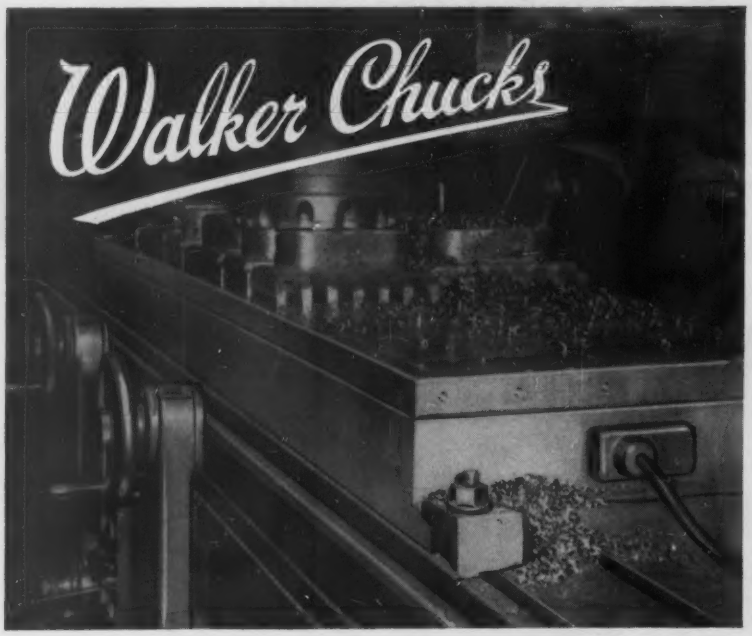
GEAR TESTING MACHINERY

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, Cut

Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Mass. Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

(Continued on page 336)



WALKER special magnetically controlled chuck eliminates magnetization of tool and machine

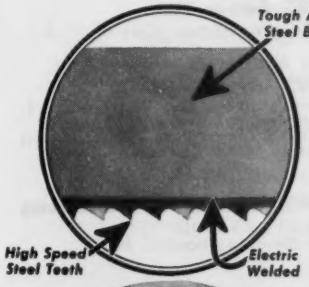
The unusual feature of this outstanding advance is chip control in milling and planing operations. This powerful special chuck holds for intermittent cuts on rough steel castings using approximately 50% of the available contact area between work and chuck face. Another notable O. S. Walker accomplishment.

Hold Everything with Walker Chucks

O. S. WALKER CO. Inc.
WORCESTER 6, MASSACHUSETTS
Original Designers and Builders of Magnetic Chucks

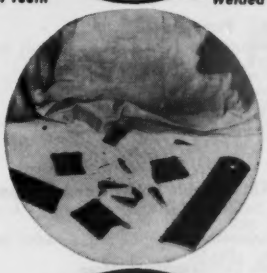
For more information on products advertised, use Inquiry Card, page 245

Features Essential to Top Hack Saw Blade Performance



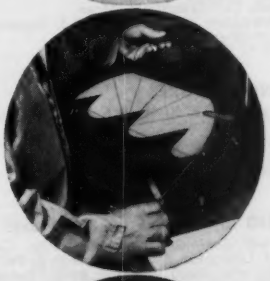
UNBREAKABLE—to saw FASTER.

Composite construction (a narrow high speed steel tooth edge electrically welded by the MARVEL-invented process to a tough, non-brittle alloy steel body), means that MARVEL high-speed-edge can be subjected to the MAXIMUM feed pressure that any hack sawing machine is capable of applying. MARVEL blades need not be "babied" for fear of breakage!



SHATTERPROOF—for SAFETY.

MARVEL blades never shatter or "explode" as do the ordinary "brittle" blades shown at left which so often cause personal-injury accidents such as the loss of an eye or severe laceration and expensive damage to the sawing machine. Operators who use MARVEL blades exclusively soon "get the habit" to apply heavier feeds, greater blade tension, higher speeds—to do their work faster, because they know they are SAFE with MARVEL.



SHARPER, PREMIUM-STEEL TEETH—to wear LONGER.

Teeth are accurately machined by a MARVEL-invented process that assures sharper tooth points and positive uniformity of tooth shape and degree of set from end-to-end of every MARVEL blade. The steel used in the tooth edge is carefully selected from the finest high speed steels available throughout the world, regardless of cost or source—truly premium steels, without premium cost.

QUALITY CONTROL—to assure UNIFORMITY.

With more than a quarter century of *experience* in inventing, perfecting, and producing welded-edge hack saw blades, MARVEL has provided its own laboratory with the most modern metallurgical instruments and techniques known to the applicable sciences for the specific purpose of maintaining highest possible quality control. Coupled with rigid tests and meticulous inspection of every MARVEL blade, uniform quality is assured.

These are only a few features that make MARVEL High-Speed-Edge Blades such outstanding performers

Ask for the latest MARVEL Cutting Tool Bulletin and the name of your closest MARVEL Distributor.

MARVEL *Metal Cutting* SAWS

Better Machines-Better Blades

Manufactured only by

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Micron Gear Mfg. Co., 102-38 Corona Ave., Corona, N. Y.
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New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Perkins Machine & Gear Co., West Springfield, Mass.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GEARS, Rawhide and Non-Metallic

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GENERATORS, Electric

General Electric Co., Schenectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

GRADUATING MACHINES

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.

GREASE

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.

GRINDERS, Carbide Tool

See Grinding Mches, Carbide Tool

GRINDERS, Die and Mold

Consolidated Mch. Tool Corp., Rochester, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

GRINDERS, Oilstone, for Woodworking Tools

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Conn.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

GRINDERS, Portable Electric and Toolpost

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

GRINDING FIXTURES

Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Geometric Tool Co. (Die Chaser), Westville Station, New Haven 15, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Millers Falls Co., Greenfield, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.
Walker-Turner Div. Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

(*Continued on page* 338)

RUGGED ALTERCUT REAMERS *Outperform* ALL OTHER REAMERS

A really rugged application for any reamer is the illustrated clearance reaming of cast iron burners for pilot generators. This reaming operation is particularly tough on reamers because they often encounter insufficient stock to cut at highest efficiency and sometimes only rub.

Under these adverse conditions, ordinary reamers would soon dull and need resharpening. Yet, this west coast manufacturer reports the 1" diameter Altercut reamers, which are operated at 75 S.F.P.M., consistently provide between 2500 and 3000 holes per grind to outperform all other reamers matched against them.

There is a Whitman & Barnes reamer for your job—try it today for better results and reduced costs.

W&B

YOUR INDUSTRIAL DISTRIBUTOR
Can Give You Quick Service
On Whitman & Barnes Tools.
Contact Him Today!

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the best running mate your product can have–

DELCO MOTORS

With exceptionally long life and outstanding quality built in . . . with worldwide recognition and acceptance—a Delco motor adds a unique plus value to any product it serves.

Delco fractional and integral motors are readily available in a wide range of sizes to assure you of the best running mate *your* product can have.

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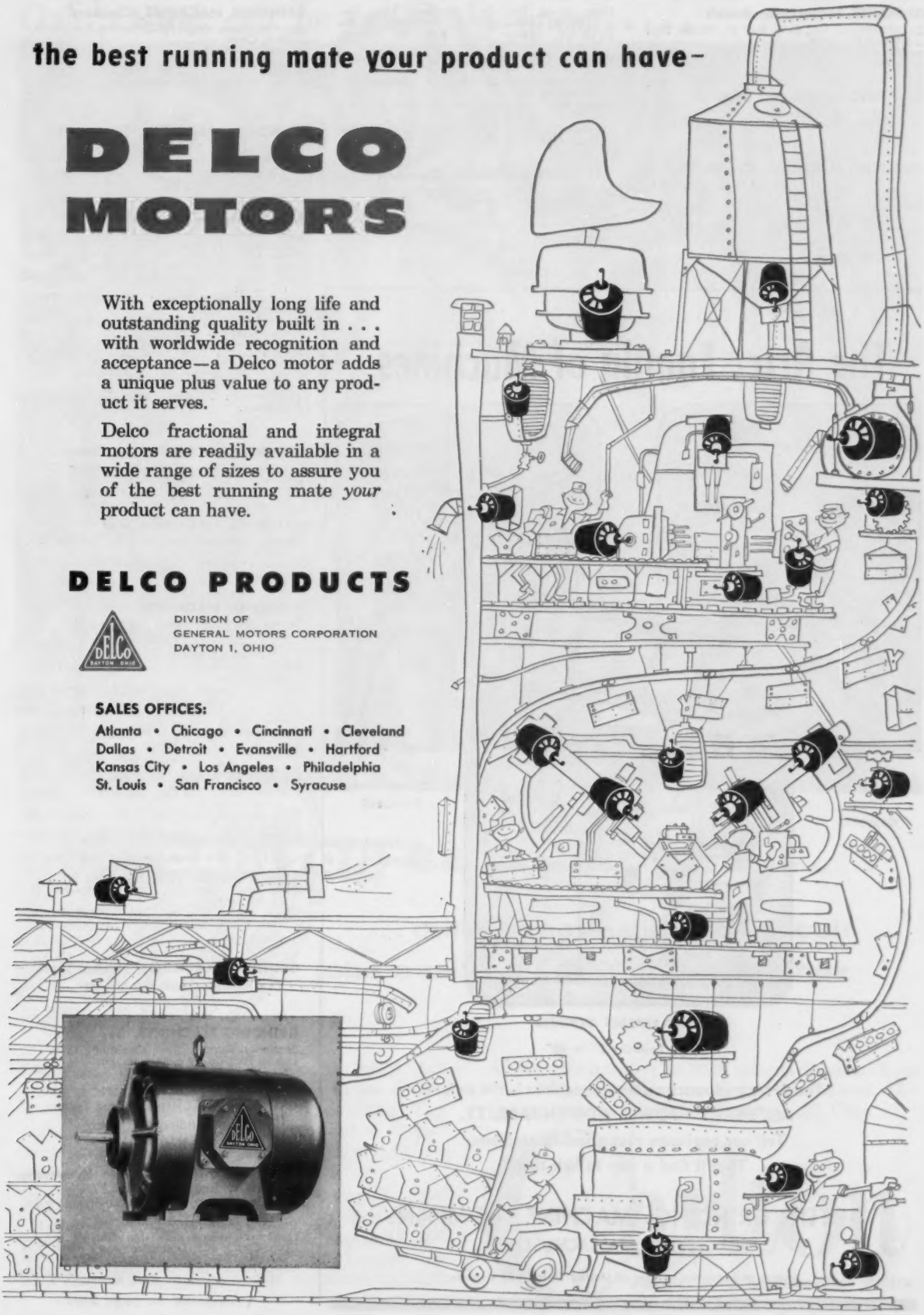


GRINDING MACHINES, Broach
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

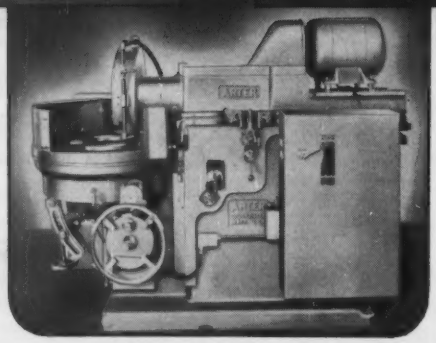
GRINDING MACHINES, Camshaft
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Carbide Tool
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GRINDING MACHINES, Centerless
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

The Arter Family of Machines

CARBIDE TOOL GRINDERS



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INTERNAL GRINDERS

ROTARY SURFACE GRINDERS
Chuck Capacity 8" to 40"

The Arter trademark on these machines is the sign of
ACCURACY • POWER • DEPENDABILITY.
Tell our engineers your grinding problems.
They'll find a way to lick them.

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WORCESTER • MASSACHUSETTS

Agents in industrial centers of United States and Canada

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Baird Machines Co., 1700 Stratford Ave., Stratford, Conn.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Crankshaft
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Cylindrical
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Bighton, Boston 35, Mass.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

GRINDER MACHINES, Die Chaser
Eastern Mch. Screw Corp., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Disc
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.

GRINDING MACHINES, Drill
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, Face
Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

GRINDING MACHINES, Flexible Shaft
See Flexible Shaft Equipment

GRINDING MACHINES, Gap
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.

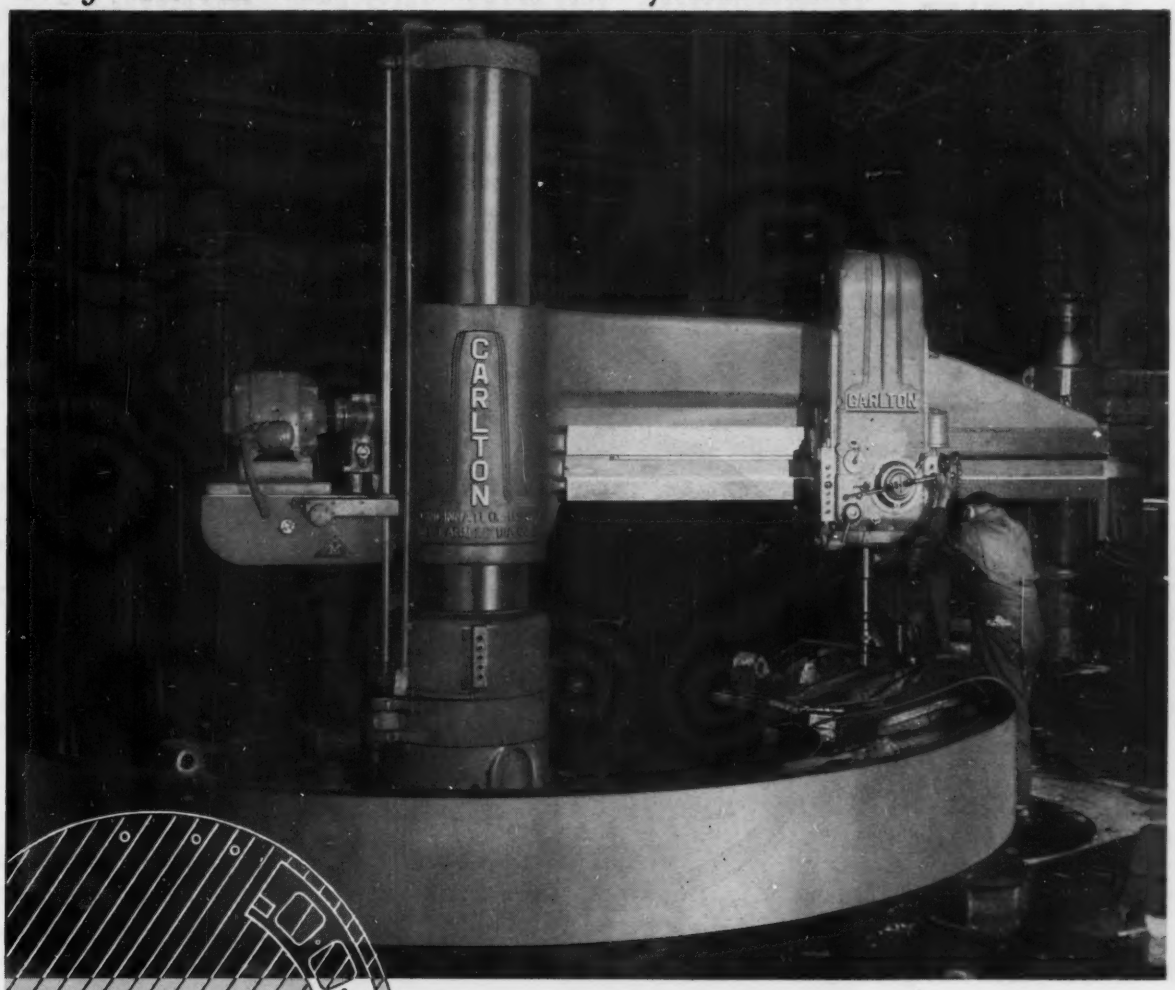
GRINDING MACHINES, Gear Tooth
See Gear Grinding Machines

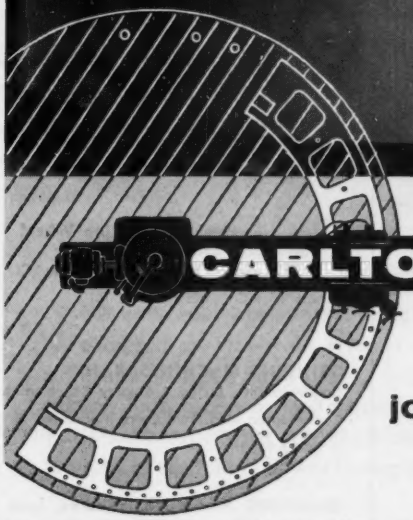
GRINDING MACHINES For Sharpening Cutters, Reamers, Hobs, Etc.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.

(*Continued on page* 340)

For more information on products advertised, use Inquiry Card, page 245

Only **ONE** *can be called the finest.....*





CARLTON GETS AROUND...

...drills even the most difficult jobs easily, quickly and efficiently

Enormous capacity of the Carlton 5A radial drill (10-ft. arm, 26″ diameter column) allows you to drill all the holes in your large castings *at one setting*. This saving in reduced handling time is matched by precision accuracy – with Carlton you drill it right the first time.

You benefit in many other ways with Carlton radial drills: pushbutton control, super-precision column clamp, low-hung drive, positive tooth feed clutch and easy, economical maintenance. Check Carlton and you'll buy Carlton, the completely modern radial drill.

Arm lengths from 3-ft. to 12-ft., column diameters from 9″ to 26″. Send today for descriptive bulletin. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

Carlton

radial and horizontal drills

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, For Sharpening Turning and Planing Tools

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Machine Works, Newton St., Waltham, Mass.

GRINDING MACHINES, Internal

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, 32, Mich.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.

Quality pays off

*SAJO in operation tells its own story**

"SAJO" and "Quality" are synonymous. The high standards and painstaking Swedish craftsmanship on which the SAJO reputation has been established are faithfully maintained in all SAJO Milling Machines. They are built to assure the accuracy and dependability which mean profitable operation—and their cost is surprisingly low. Available in 3 models!

Model 54 (illustrated) a full No. 2 capacity ALL-GEARED Miller—Plain or Universal types—with 5 HP main drive motor and 1½ HP table feed motor; #50 NMT spindle; 16 spindle speeds up to 1500 RPM; single lever speed and feed selectors with direct reading dials; single lever control for START-STOP-BRAKE; table power feed and POWER RAPID TRAVERSE in 3 directions. Model 53 Light Duty No. 2 ALL-GEARED Miller. Model 48 Light Duty No. 2 Utility Miller.

*Ask for references

austin industrial corp.

76-E MAMARONECK AVE., WHITE PLAINS, N.Y.

Look for the Austin Seal—your full guarantee of satisfaction.

GRINDING MACHINES, Jig

Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Moore Special Tool Co. Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING MACHINES, Knife and Shear Blade

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
United States Electrical Tool Div., Emerson Elec. Mfg. Co., 1050 Findlay St., Cincinnati 14, Ohio.

GRINDING MACHINES, Piston Ring

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Profile

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cleveland Grinding Machine Co., 1643 Eddy Rd., Cleveland 12, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

GRINDING MACHINES, Ring Wheel Ball Race, Etc.

Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Radial

Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

GRINDING MACHINES, Radius, Link

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll

Farrel-Birmingham Co., 25 Main St., Ansonia, Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft

Van Norman Co., Springfield, Mass.

(*Continued on page* 342)

For more information on products advertised, use Inquiry Card, page 245

Caterpillar-Built Tractor Equipment
Speeded With
STEELWELD PRESSES

Caterpillar DW20 Tractor with W20 Wagon.

Tractor equipment parts produced on this and other Steelweld Presses at Caterpillar are of various thicknesses and require many different bends. This is a Model K5-10 Press rated at 320 tons.

THE ease and speed with which dies can be changed on Steelweld Presses and necessary adjustments made have proven a big asset in obtaining high production of a great variety of steel parts for scrapers, rippers, bulldozer blades and wagons at the Joliet Plant of Caterpillar Tractor Co.

Because of simplicity of Steelweld operation, the parts can be turned out quickly and accurately. The heavy quality construction, including solid one-piece frame, finest electrical equipment and automatic oilers for lubrication of all bearings, keep Steelweld Press maintenance extremely low and assure uninterrupted production.

GET THIS BOOK!

CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

5449 EAST 281st STREET, WICKLIFFE, OHIO

STEELWELD
BENDING PRESSES
BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

GRINDING MACHINES, Surface

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Germanow Simon Mch. Co., 388 St. Paul St., Rochester, N. Y.
Gollmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reid Bros. Co., Inc., Beverly, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDING MACHINES, Thread

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

GRINDING MACHINES, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

GRINDING MACHINES, Worm

Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING WHEELS

Blanchard Machine Co., 64 State St., Cambridge, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co. (Surface Grinder), 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.

GROOVE PINS

Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.

GROOVING TOOLS, Internal

Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

HAMMERS, Drop

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Morgan Engrg Co., Alliance, Ohio.

HAMMERS, Forging Air

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 200 "G" St., Wilmington 99, Del.

HAMMERS, Pneumatic

Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.

HAMMERS, Portable Electric

Black & Decker Mfg. Co., E. Penna Ave., Towson, Md.
Millers Falls Co., Greenfield, Mass.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.

HAMMERS, Shaft

Standard Pressed Steel Co., Jenkintown, Pa.

(*Continued on page 344*)

Send for these NEW Spec Sheets

WHICH SHOULD BE IN YOUR FILES

Just off the press—

Catalog P-100	Ferracute Punching Presses Standard Throat Non-adjustable Bed 20 to 105-ton Models
Catalog P-200	Ferracute Punching Presses Adjustable Bed Standard Throat 20 to 105-ton Models
Catalog P-300	Ferracute Punching Presses Deep-Throated 20 to 105-ton Models 12 to 80-inch Throats
Catalog P-400	Ferracute Punching Presses 150 and 200-ton Models

WRITE FOR YOUR COPIES

FERRACUTE MACHINE CO.

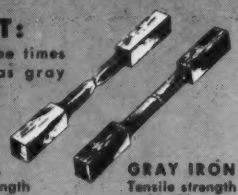
Since 1863, Manufacturers of Power Presses, Press Brakes and Special Machinery

Bridgeton, New Jersey, U. S. A.

For more information on products advertised, use Inquiry Card, page 245

FACTS THAT FIGURE in lower costs

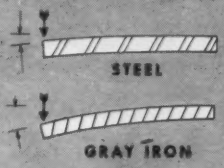
FACT:
Steel is three times as strong as gray iron.



STEEL
Tensile strength
61,800 psi

GRAY IRON
Tensile strength
20,420 psi

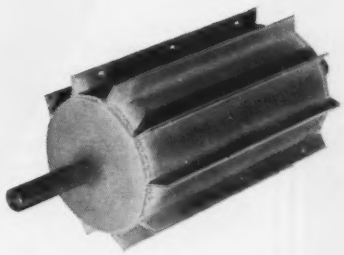
FACT:
Steel is two and one half times as rigid as gray iron.



FACT:
Steel costs only a third as much as gray iron.

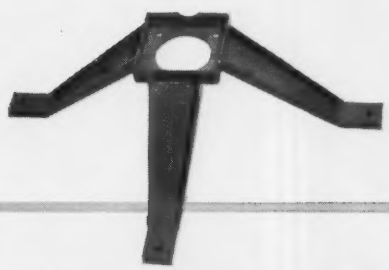
AND SO... *by manufacturing your products from welded steel, costs can be reduced up to 50%.*

Why steel designs cost less



COSTS 45% LESS

Feeder roll is built from standard channel welded to steel discs. Steel design eliminates breakage, weighs half of former casting. Saves 45% on cost of manufacture.



COSTS 30% LESS

Machine bracket is welded from 10 gauge metal. Weighs half of original cast design. Cut is stronger, more rigid. Costs 30% less to produce.

HOW YOU CAN CUT COSTS...NOW

BECAUSE steel is stronger, more rigid than iron, yet costs a third as much per pound, costs on many products can be cut up to 50%.

You can realize savings like these on your designs, on products you manufacture, without disrupting production. Simply change over your designs one part at a time.

A Lincoln representative will gladly work with you to save your time. He can show you how to simplify design details and cut costly production man-hours. Call him.

Cuts design costs

WELDesign manual shows how to convert designs to welded steel with minimum design time. Available to product engineers and designers for home study at nominal cost. Write . . .

THE LINCOLN ELECTRIC COMPANY
DEPT. 1208, CLEVELAND 17, OHIO
THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

HAMMERS, Soft

Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HARDENING EQUIPMENT

Gleason Works, 1000 University Ave., Rochester, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

HARDENING MACHINES, Flame

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Gleason Works, 1000 University Ave., Rochester, N. Y.

HARDNESS TESTING INSTRUMENTS

Olsen, Tinius, Testing Mch. Co., Philadelphia Pa.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shore Instrument & Mfg. Co., Van Wyck Ave., and Carll St., Jamaica, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

HEADING MACHINES

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

HOBBING MACHINES

See Gear Cutting Machines, Spur and Helical Gears (Hobbing), and Gear Cutting Machines, Worm and Worm Wheels.

HOBS

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Union Twist Drill Co., Athol, Mass.

HOIST HOOKS

Bethlehem Steel Co., Bethlehem, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HOISTING AND CONVEYING EQUIPMENT

Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

HOISTS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.

HOISTS, Chain, Etc.

Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

HOISTS, Electric

Philadelphia Gear Works Inc., Erie Ave. and G St., Philadelphia, Pa.

HONING MACHINES, External

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.

HONING MACHINES, Internal (Cylinder)

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette. Detroit 7, Mich.

HONING STONES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Moline Tool Co., 102 20th St., Moline, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.

HONING TOOLS AND FIXTURES

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.

HOSE, Leather, Rubber, Metallic, Etc.

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.
Nogren, C. A., Co., Inc., 3419 S. Elati St., Englewood, Colo.

HYDRAULIC MACHINERY Tools and equipment

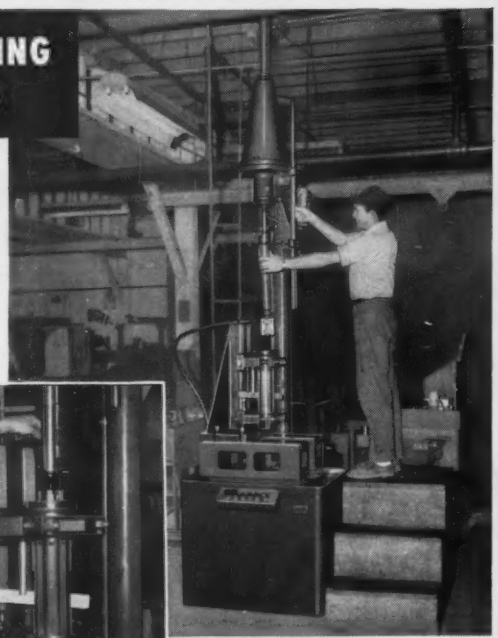
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.

(*Continued on page 346*)

Only TWO EASY STEPS . . . both AMAZINGLY SWIFT AND EFFICIENT

for fast, accurate, uniform precision finishing

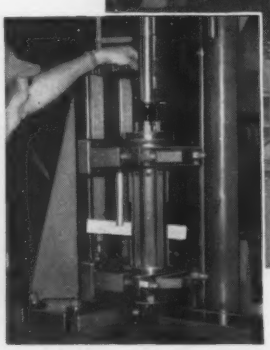
FULMER HONING MACHINES



1. Honing stones SHEAR off the protuberances from the internal bores . . . then

2. FINISH the internal surfaces to geometric accuracy so rapidly that as much as 1/16 inch is removed from the diameter at a rate of 1 1/2 to 2 cu. inches or more per minute.

Fulmer Honing Machines speed cutting and finishing and insure dimensional accuracy to tolerance of .0001 (+) in every internal honing operation.



for ferrous and non-ferrous metals, plastics, glass etc.

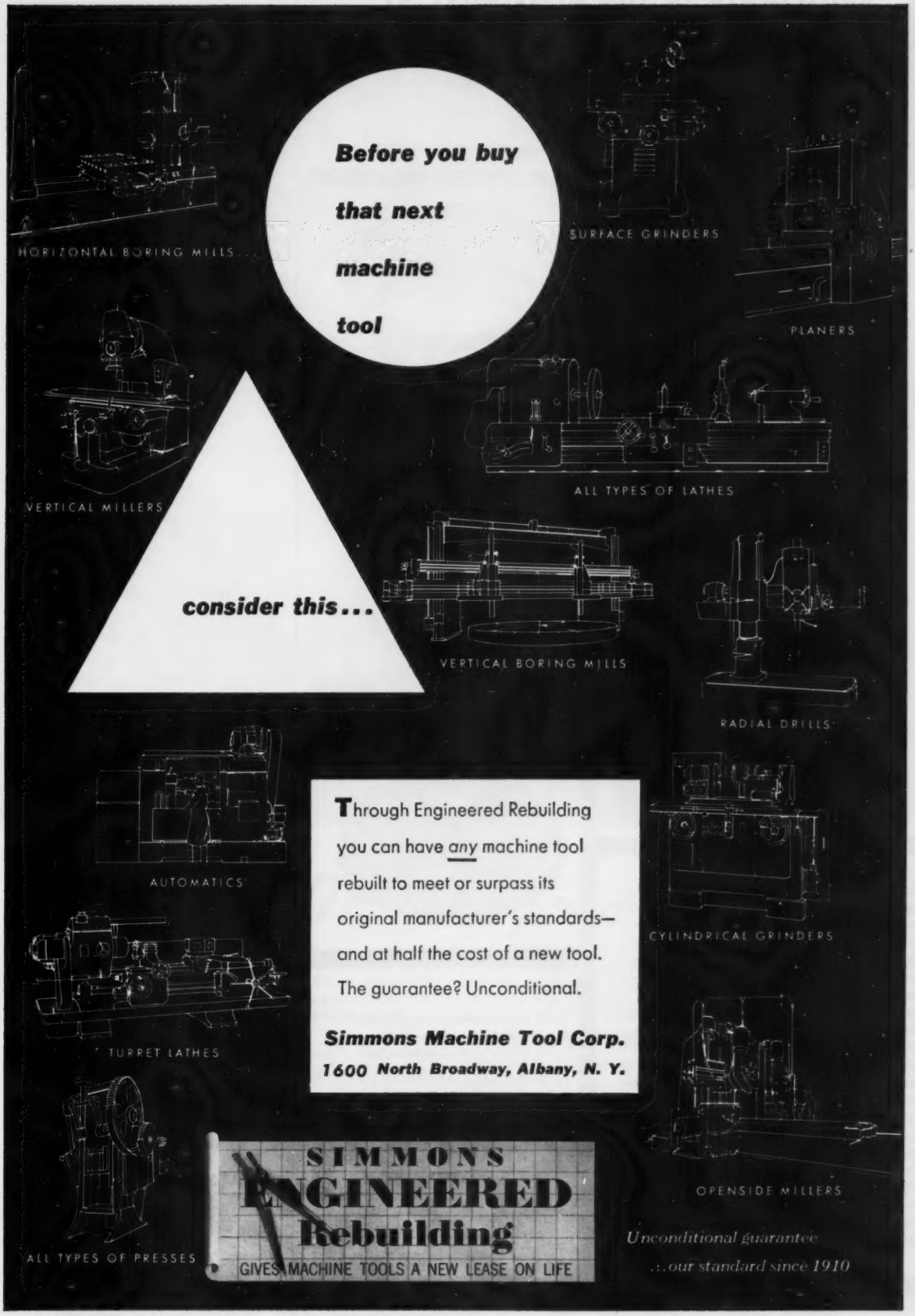
Photograph shows Fayscott Corporation of Dexter, Maine, honing spindle sleeves for Giddings & Lewis boring mills.

WRITE FOR BULLETIN ON HONING

C. ALLEN FULMER CO.

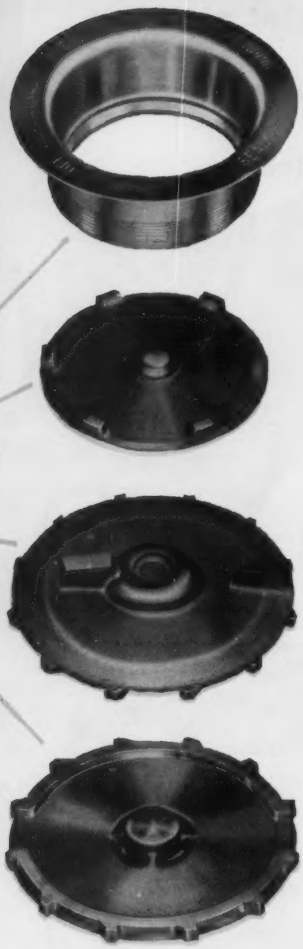
1231 First National Bank Bldg. Cincinnati 2, Ohio

For more information on products advertised, use Inquiry Card, page 245


Before you buy that next machine tool
consider this...
HORIZONTAL BORING MILLS
SURFACE GRINDERS
PLANERS
VERTICAL MILLERS
ALL TYPES OF LATHES
VERTICAL BORING MILLS
RADIAL DRILLS
AUTOMATICS
CYLINDRICAL GRINDERS
TURRET LATHES
OPENSIDE MILLERS
ALL TYPES OF PRESSES
Through Engineered Rebuilding you can have any machine tool rebuilt to meet or surpass its original manufacturer's standards—and at half the cost of a new tool. The guarantee? Unconditional.
Simmons Machine Tool Corp.
1600 North Broadway, Albany, N. Y.
SIMMONS
ENGINEERED
Rebuilding
GIVES MACHINE TOOLS A NEW LEASE ON LIFE
Unconditional guarantee
...our standard since 1910

MUELLER BRASS CO. forgings* contribute to the efficiency of this modern waste disposal unit

***MUELLER BRASS CO. facilities include: designing, die-making, forging, tooling, machining, polishing, plating and assembly**



Three Mueller Brass Co. forgings play an important part in the fine operating performance of this modern waste disposal unit made by the Eureka-Williams Co., Division of the Henney Motor Co., Inc. This unit does a speedy and thoroughly effective job of pulverizing garbage and has made life easier for American housewives. The impeller disposer that chops up the waste food in the disposal unit, the disposer cover and the sink mounting flange are all forged by the Mueller Brass Co. This is another outstanding instance where Mueller Brass Co. forgings have improved product performance and cut costs. High quality forgings can be produced from standard and special brass, bronze and aluminum alloys. And in addition, the Mueller Brass Co. offers complete service ranging from product design to finished part . . . Write today for complete information and new 32 page forgings handbook.

1. Sink mounting flange, forged, machined, nickel and chrome plated by Mueller Brass Co.
2. Machined and finished disposer cover forging.
3. Cutting side of impeller disposer forged from 600 series bearing bronze.
4. Reverse side of impeller disposer.

MUELLER BRASS CO.

PORT HURON 35, MICHIGAN

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman, Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

HYDRAULIC POWER UNITS OR TOOL HEADS

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes John S., Corp., Rockford, Ill.
Barnes W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

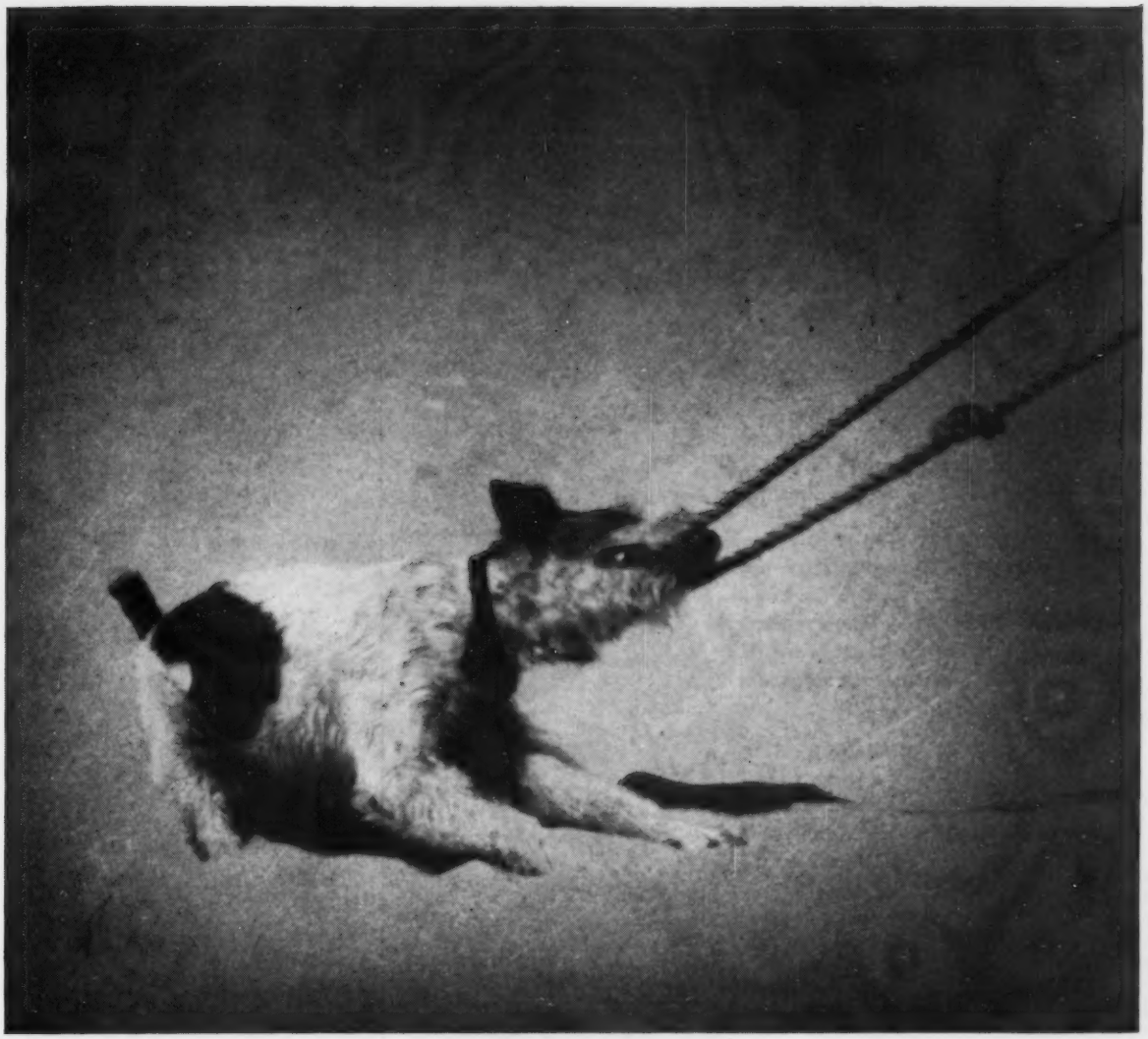
INDEXING AND SPACING EQUIPMENT

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

INDICATORS, Dial

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

(*Continued on page* 348)



BONDERITE holds paint to metal!

There's a constant tug-of-war between corrosive action and the paint finish on your metal products. The paint tries to stick to the metal; the natural forces of corrosion try to lift it off.

Bonderite is the "anchor man", throwing its strength on the side of lasting, durable paint finishes.

This excellent product, simple and economical in operation and uniformly effective in results, creates a nonmetallic coating integral with the metal surfaces. The coating anchors organic finishes, is a stout corrosion resistant, and prevents the spread of finish failure should the paint film be broken by scratch or dent.

Bonderite adds quality to painted metal products by lengthening the durability and appearance life of paint finishes. Bonderite adds sales appeal because your customers know about it and the benefits it brings.

Investigate Bonderite for your product NOW! Write or call.

**Bonderite, Bonderlube, Parco, Parco Lubrite—Reg. U.S. Pat. Off.*

PROTECTED BY Bonderite A PARKER RUST PROOF CO. QUALITY CORROSION RESISTANT

Since 1915—Leader in the Field

PARKER RUST PROOF COMPANY

2194 E. Milwaukee, Detroit 11, Michigan

BONDERITE	BONDERITE and BONDERLUBE	PARCO COMPOUND	PARCO LUBRITE	TROPICAL
corrosion resistant paint base	aids in cold forming of metals	rust resistant	wear resistant for friction surfaces	heavy duty maintenance paints since 1883

So Efficient—

OLIVER ACE

Universal Tool and Cutter Grinders

The Oliver ACE grinds cutters of all types—increases productivity—and offers unsurpassed advantages for *your* toolroom. Four decades of proved dependability makes possible these 4 most important advantages:

1 Easy to operate—the ACE requires no computation . . . direct reading for clearances . . . reduces fatigue . . . eases operators' jobs in grinding the most difficult cutters.

2 Speedy to operate—the ACE cuts time lags to the bone . . . simplicity of design and operation makes economy of motion and fast grinding certain.

3 Precision guaranteed—the ACE handles a wider range of cutters than ordinary cutter grinders (includes high speed and tungsten-carbide work) . . . only two simple fixtures required.

4 Economy assured—the ACE is unmatched for its unexcelled ease, speed and precision of operation. It is not only easy to set up but needs only a small amount of floor space and requires less outlay in dollars.

Direct Reading for Clearance

—Reduces Fatigue

—Eases Operators' Jobs

Time proved, dependable and soundly engineered — the Oliver ACE Universal Tool and Cutter Grinder is built to give you many years of unsurpassed service. Like thousands of others, find out for yourself why the Best Way . . . is the Oliver Way.

Priced to meet your budget, the ACE excels for grinding face mills up to 15"—also, slab mills • slitting saws • dovetail cutters • angular cutters • double angle cutters • Fellows helical cutters • reamers • taper reamers • production gashing and carbide tipped circular wood saws.

2 MODELS: Standard and Heavy Duty (illustrated)

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MACHINE TOOLS by OLIVER include:
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DRILL POINT THINNERS
TEMPLATE TOOL GRINDERS
FACE MILL GRINDERS
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Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Test
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
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General Electric Co., Schenectady, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

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Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Morgan Engrg. Co., Alliance, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

JACKS, Planer
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

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See Boring Machines, Jig.

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Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Jahn B., Manufacturing Co., Ellis St., New Britain, Conn.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
National Broach & Machine Co., 5600 St. Jean St., Detroit 13, Mich.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

JOINTS
See Fittings, Hydraulic, Pneumatic, Etc.

KEYS, Woodruff, Machine, Special.
Standard Automotive Parts Co., 660-668 Nims, St., Muskegon, Mich.

KEYSEATERS
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Co., Rochester, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester, 8, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Mitts & Merrill, 68 Holden St., Saginaw, Mich.

KNURL HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.

KNURLING TOOLS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

(*Continued on page* 350)

NEW KENDEX* tooling slashes cost per cutting edge

It's entirely new . . . everything except the long-established Kendex "throwaway button" principle pioneered and proved by Kennametal.

We took a good look at tool cost per cutting edge and designed a new Kendex with a clamp-on, "turnover" insert, plus a new system of chip control. This combination eliminates all regrinding, doubles the usable cutting edges per insert, and slashes tool cost on all types of machining operations. For example: On one job, tool cost was cut from $1.13 to $0.06 per piece.

NEW "TURNOVER" INSERTS

The new "turnover" inserts are designed with cutting edges on both sides, and can be indexed in seconds. After all cutting edges are used on one side, simply turn them over and use an equal number on the reverse side. Square inserts have eight cutting edges; triangular inserts, six.

These cost-reducing inserts are available in two types: (1) Regular, ground on top and bottom with corner radii ground for indexing; (2) Precision inserts, ground on all sides for precision indexing. When all edges are used . . . replace the insert and eliminate regrinding.

The new Kendex comes in a range of sizes in two models—Standard and Heavy-Duty. The Standard model is available with either Regular or Precision inserts; the Heavy-Duty with Regular inserts only.

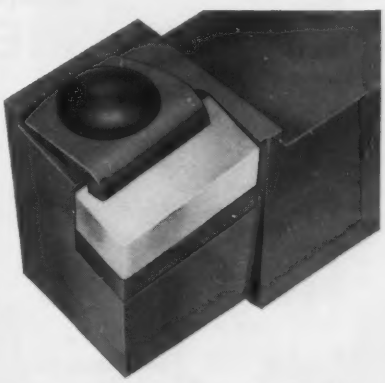
NEW CHIP CONTROL SYSTEM

The new Kendex design not only eliminates regrinding of inserts, but the grinding of chip breakers as well. Standard Kendex tools have replaceable carbide chip breakers which have the widest effective application of any mechanical chip breakers available. On many jobs, the chip breaker can be removed to prolong tool life. Heavy-Duty sizes (shown at right) are fitted with rigid, inexpensive spring clamps which serve as chip deflectors.

Replaceable, hardened steel shims (available on the larger shanks) prolong tool life, reduce tool maintenance, and eliminate grinding of holders in case of accident with the tool.

For complete information, call your Kennametal representative, or write KENNAMETAL, INC., Latrobe, Pennsylvania.

*Registered trademark



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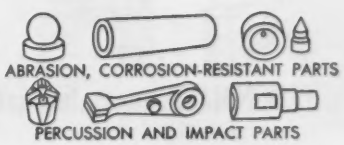

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Barnes Drill Co. (Straight Line or Rotating), 814 Chestnut St., Rockford, Ill.
Cincinnati Grinders, Inc., (Centerless), Cincinnati, Ohio.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

LAPPING PLATES, Hand

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.

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Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Axelson Mfg. Co., P.O. Box 15335, Verona St., Los Angeles 58, Cal.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch., 160 Clinton St., Springfield, Vt.
Knapp, B. L., Ind. 107 N. Franklin Ave., Syracuse 4, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford. Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Sunstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

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CHICAGO U. S. A.

More will be *profit* with a SHELDON

It actually costs less to do turning jobs on a Sheldon Precision Lathe. Machine-tool investment is cut to a fraction. Power cost is materially reduced. Less experienced operators can operate Sheldons safely and efficiently. Even cost-loadings for plant—floor space, heat and light are lower because two Sheldons can often operate in the space occupied by one large lathe.

On most "everyday" jobs a Sheldon will actually turn out more pieces per hour too. With double V-belts to the spindle Sheldon lathes deliver enough power to take heavy cuts in direct drive, at high speeds. Sheldon's "Zero Precision" Taper Roller Bearings permit work to the closest tolerances. Seldom are such extremely accurate bearings used in moderate priced lathes.

You will actually keep more as profit if you use Sheldon Lathes.

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Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Axle

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards, Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

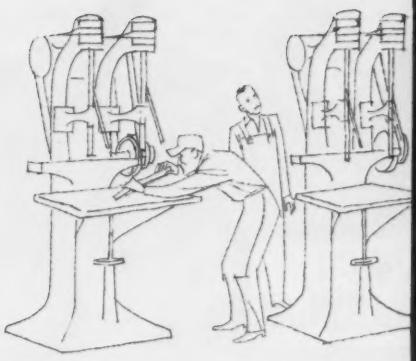
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Boring

Axelson Mfg. Co., P.O. Box 15335, Verona St., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

(*Continued on page 352*)

For more information on products advertised, use Inquiry Card, page 245



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with NEW Leland-Gifford Drilling Machines

Right now many of us have a breathing spell in the hurly-burly of production bottlenecks and backlogs. It's a great opportunity to get set for the stiff competition coming up — to beat the squeeze on profits already being felt.

Take a good look at the drilling machines which have been fighting your production battles for years. Then compare them with the new Leland-Gifford drilling machines.

With convenient central controls, fast speed changes, reduced work handling and many other advanced features, these modern drilling machines can boost production and accuracy to the point where profits are considerably widened and competition is not only met but bettered.

Your inquiries and orders will receive immediate, complete and personal attention. Deliveries can be made *promptly*.

Get in touch with the office nearest you or write for complete information.

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- **ROCHESTER 18**
  P. O. Box 67, Roselawn Station

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LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Duplicating

Axelson Mfg. Co., P.O. Box 15335, Verona St., Los Angeles 58, Cal.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Hydro-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Engine and Toolroom

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Morey Machinery Co., Inc., 383 Lafayette St., New York, N. Y.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio
Simmons Machine Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.

LATHES, Gap

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
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Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Co., Sidney, Ohio.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Gun

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta. Los Angeles 58, Cal.
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Springfield Machine Tool Co., Springfield, Ohio.

LATHES, Hollow Spindle

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Manufacturing Type

Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
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Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

LATHES, Spinning

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.

LATHES, Toolroom

See Lathes, Engine and Toolroom.

LATHES, Turret

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Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Morey Machinery Co., Inc., 383 Lafayette St., New York, N. Y.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Potter & Johnson Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Vertical Turret

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

LAYOUT FLUID

Dykem Co., 2303 P. North 11th St., St. Louis 6, Mo.

LEVELS

Bullard Co., Brewster St., Bridgeport 2, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Link-Belt Co. (For Positioning Bearings), 519 N. Holmes Ave., Indianapolis 6, Ind.

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Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.

(*Continued on page 354*)

No Complicated Hydraulic or Electronic Controls

Fast set-up for short or production runs. Requires no permanent lathe alterations. Accommodates all types of tool holders, square turrets, grinding attachments, clapper boxes, boring bars, etc. For contour turning, facing, grinding, boring, Bullard operations. Unlimited radii, 90° steps, threading to a shoulder, etc. Uses low cost, easily made templates. Models for all lathes 9" to 24" and larger. Thoroughly proven in shops and plants of every size.

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Manufacturers of LEHIGH Air Valves • Air Cylinders • Air Hoists • Air Motors

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THIS Verson TOOL-UP PRODUCES OVER 1000 VALVE COVERS PER HOUR *Automatically*

Consisting of a Verson Transmat Press and Verson Tooling, this is an outstanding example of automatic stamping possibilities where production requirements are high. The press is a 600 ton, 6 station Transmat in which stock is fed from a coil. Five operations on valve covers for overhead valve engines are performed automatically without intermediate handling.

If you mass produce stampings, investigate the economy of Transmat production. For specific recommendations, send an outline of your requirements or write for your copy of the Transmat brochure.

A Verson Press for every job from 60 tons up.

Verson

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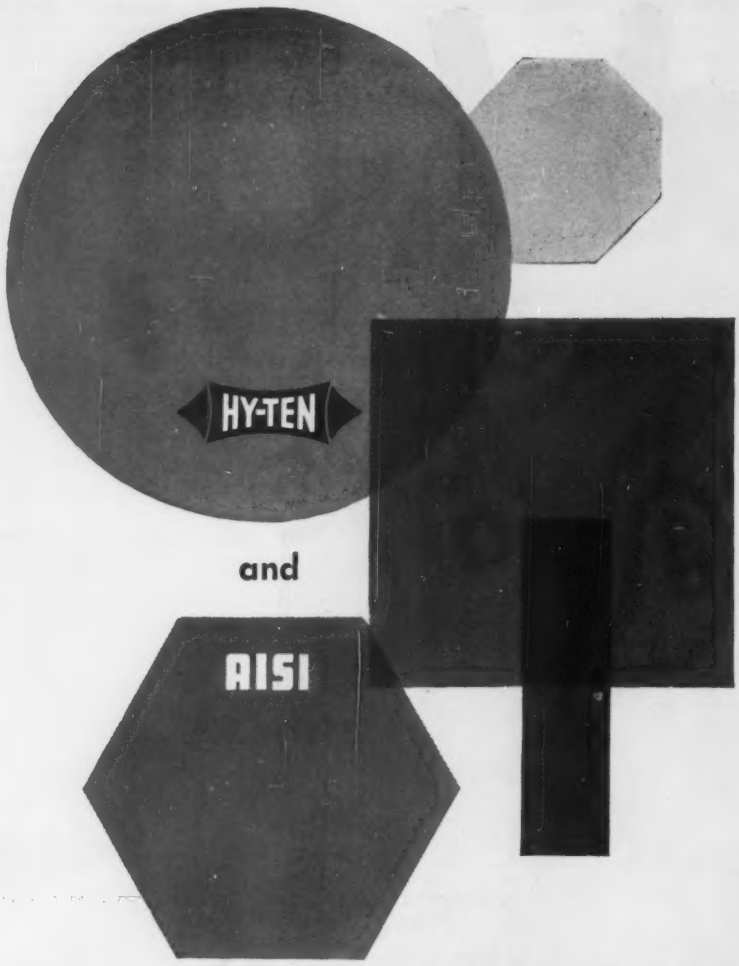

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Shear-Speed Chem. Prod. Div., Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

LUBRICATING SYSTEMS

Farval Corp., 3249 E. 80th St., Cleveland, Ohio.
Madison-Kipp Corp., Madison, Wis.
Norgren, C. A., Co., Inc., 3419 S. Elati St., Englewood, Colo.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

MACHINE KEYS

Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.

MACHINE PARTS, Special

Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.

MACHINISTS' SMALL TOOLS

See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

MANDRELS

See Arbors and Mandrels.

MARKING MACHINES AND DEVICES

Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit, Mich.

MEASURING MACHINES AND INSTRUMENTS, Precision

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Crane Parking Co., 1800 Cuyler Ave., Chicago.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MEASURING WIRES, THREAD, SPLINE AND GEAR

Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

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See Bearings, Bronze, Babbitt, Etc., and Bushings, Brass, Bronze, Etc.

METAL FINISHINGS

Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.

METERS

See Recording Instruments.

MICROMETERS

Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co. Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

(*Continued on page* 356)

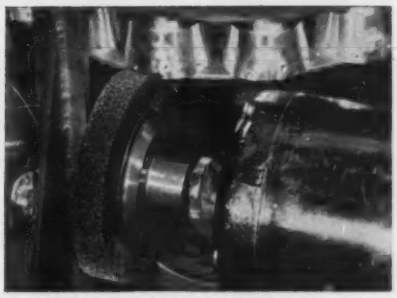
For more information on products advertised, use Inquiry Card, page 245

Faster production with power brushing

Here's how you can get it in your plant

AN Osborn Brushing Specialist knows where power brushing fits into the overall production picture. In making an **O**sborn **B**rushing **A**nalysis, he studies all cleaning, finishing and burr removal operations. Then, he analyzes these operations and submits a written report that tells where power brushing could speed production or improve quality.

Such an analysis has resulted in big savings in many plants. It could do the same for you. There is no obligation for an **OBA**. Just call or write *The Osborn Manufacturing Company, Dept. D-24, 5401 Hamilton Avenue, Cleveland 14, Ohio.*



4 TIMES FASTER. *Here, "push-button" brushing with Osborn Master® Wheels removes feather burrs at a rate of 1400 parts an hour. By former hand method, output was 360 per hour. An* **OBA** *can help speed your production, too.*

OSBORN

Osborn Brushes

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES • BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

MICROSCOPES, Toolmakers

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

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Brown & Sharpe Mfg., Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati.
Consolidated Machine Tool Corp., Rochester, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING AND CENTERING MACHINES

Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench

Barker Engrg. Co., 500 Green Rd., Cleveland 21, Ohio.
Hardinge Bros., Inc., (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
U. S. Burke Machine Tool Div., Brotherton Rd. Cincinnati 27, Ohio.

MILLING, MACHINES, Circular, Continuous

Consolidated Machine Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand

Barker Engrg. Co., 500 Green Rd., Cleveland 21, Ohio.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
U. S. Burke Machine Tool Div., Brotherton Rd. Cincinnati 27, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Horizontal, Plain and Universal

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Brown & Sharpe Mfg., Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Lincoln Type

Brown & Sharpe Mfg., Co., Providence, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Planer Type

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn. R. R. Evanston, Cincinnoti, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Profile

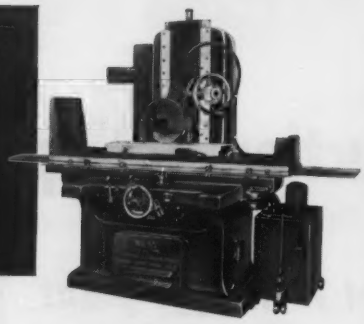
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexinton Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Ram Type Universal

Van Norman Co., 3640 Main St., Springfield 7, Mass.

(*Continued on page 358*)

When the need is for SPEED and PRECISION



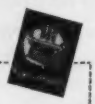
you need a

GRAND RAPIDS GRINDER

Here is extra value, extra accuracy, extra high-speed performance. Every Grand Rapids Hydraulic Feed Surface Grinder has a one-piece column and base for vibrationless rigidity and permanent alignment between cross travel ways and upright headways. Both longitudinal table travel and cross feed are hydraulically operated. On the larger machines, the wheel head is powered for rapid vertical travel. ***The model 55 has longitudinal table speed of 125 fpm.!***

Parts machined to micrometric tolerances, precision assembled for freedom of action, no play. That's why 6 out of 10 are sold to firms already using Grand Rapids Grinders.

Send for full facts today . . . we'll answer within 24 hours



GALLMEYER & LIVINGSTON

Please send me the following literature without obligation:

☐ Surface Grinder Catalog
☐ Universal Cutter and Tool Grinder Catalog

Attach to Letterhead and Mail to:
GALLMEYER & LIVINGSTON CO.
425 Straight Ave., Grand Rapids, Mich.

For more information on products advertised, use Inquiry Card, page 245

IT'S QUIET ON THE MEZZANINE ...WHILE THE MEN BELOW

rivet

...NOT 15 FEET AWAY!

This is a riveting line at the Irving Subway Grating Co., Long Island City, New York. *Yet you cannot hear the riveting!* Why? Because it's done with Hannifin "Hy-Power," the modern cold-squeeze riveting method.

Compact "Hy-Power" Portable Yoke Riveters quietly exert the force. The power is supplied by "Hy-Power" Hydraulic Pressure Generators (you see them right up there beside the man who is consulting the files) . . . compact, single units that include motor, pump, oil reservoir, control valves and high pressure intensifier.

HOW TO REDUCE YOUR RIVETING COSTS

Do it the "silent squeeze" way with Hannifin portable and stationary yoke riveters which are available in capacities from 7½ to 100 tons (more in multiple). It's a fast method. It's a method that assures complete uniformity of every rivet. It's a safe method; for while a touch of a button starts the ram, the stroke may be interrupted and the ram reversed at any point in the cycle, simply by releasing the control button.

See your Hannifin representative who will demonstrate why "Hy-Power" riveting and punching equipment has a place in your production picture. Hannifin Corporation, 509 S. Wolf Rd., Des Plaines, Ill.

WRITE FOR BULLETIN 150

The complete story of Hannifin "Hy-Power" Hydraulics. Your copy sent on request.

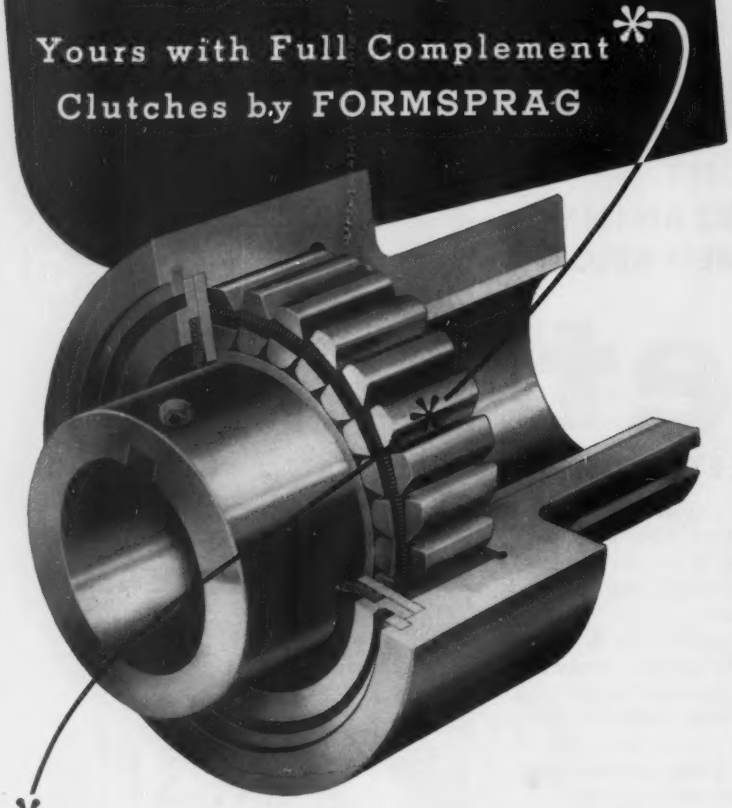
do ALL you can do . . . with

HANNIFIN

Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves

Maximum Torque Capacity— Long Life—

Yours with Full Complement Clutches by FORMSPRAG



Here's Why

You can have maximum torque capacity for size and weight plus long life because of low unit stresses at changing contact points.

A full complement of sprags is inserted in the annular space between an inner and outer race. Contact with race surfaces is maintained by energizing springs.

The energized sprags grip at an infinite number of positions. When torque is applied, the sprags *instantaneously* engage . . . when torque is removed, they *instantaneously* release. Positive, accurate engagement and disengagement may be made hundreds of times per minute – with no backlash.

OVER-RUNNING • INDEXING • BACKSTOPPING

FORMSPRAG Company E-11

23609 Hoover Road • Van Dyke, Michigan

New catalog— send for a free copy before you specify any other clutch.

MILLING MACHINES, Turret Type
Bridgeport Machines, Inc., Linley Ave., Bridgeport, Conn.

MILLING MACHINES, Vertical
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch., Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Burke Machine Tool Div., Cincinnati 27, Ohio.

MODEL AND EXPERIMENTAL WORK
See Special Machinery and Tools.

MOLD AND DIE COPYING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MOLDING MACHINES, Plastic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

MOTORS, Electric
Delco Products Div., General Motors Corp., 321 E. First St., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
Howell Electric Motor Co., Howell, Mich.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

MOTORS, Hydraulic
Gerotor May Corp., Oliver St. and Maryland Ave., Baltimore, Md.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MULTIPLE-SLIDE FORMING MACHINES
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

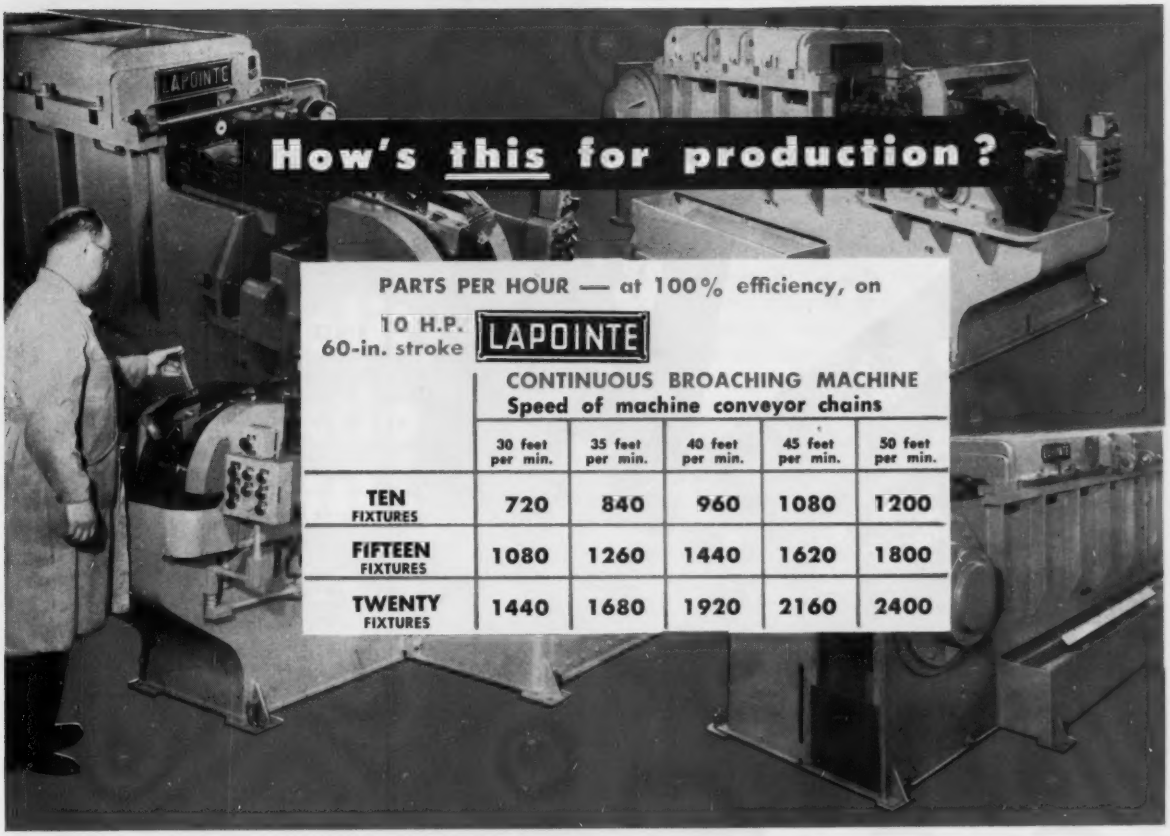
NIBBLING MACHINES
Campbell Machine Div., American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport, Conn.

NIBBLING MACHINES, Nickel
International Nickel Co., Inc., 67 Wall St., New York, N. Y.

NIPPLE THREADING MACHINERY
Landis Machine Co., Inc., Waynesboro, Pa.

(*Continued on page* 360)

For more information on products advertised, use Inquiry Card, page 245



PARTS PER HOUR — at 100% efficiency, on

10 H.P. 60-in. stroke **LAPOINTE** CONTINUOUS BROACHING MACHINE

Speed of machine conveyor chains

	30 feet per min.	35 feet per min.	40 feet per min.	45 feet per min.	50 feet per min.
TEN FIXTURES	720	840	960	1080	1200
FIFTEEN FIXTURES	1080	1260	1440	1620	1800
TWENTY FIXTURES	1440	1680	1920	2160	2400

for **CONTINUOUS** MASS-PRODUCTION **BROACHING** of contour and flat surfaces, to precision tolerances

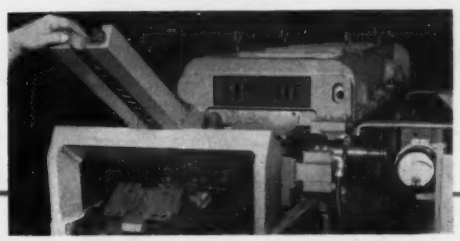
the production figures are FANTASTIC

LAPOINTE

CONTINUOUS BROACHING

(. . . with the machine that doesn't stop!)

The machine runs **all the time**, has a foolproof self-unloading feature, and delivers precision results at amazingly reduced costs! Every plant that is now mass-producing parts **by any machining process** should investigate the Lapointe Continuous Broaching Machine for money-saving advantages. Send for descriptive **Bulletin CH-1.**



Hopper feed . . . for FULL AUTOMATION!
Substantial increase in production is possible with automatic loading. Wherever practical to use, Lapointe engineers always design the machine for hopper feed.

LAPOINTE BUILDS THE MACHINE BUILDS THE FIXTURES AND MAKES THE TOOLS

Lapointe takes *all* the responsibility for your CONTINUOUS BROACHING program!

THE LAPOINTE MACHINE TOOL COMPANY
HUDSON, MASSACHUSETTS • U. S. A.
In England: Watford, Hertfordshire

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

ASK FOR ATKINS
BIG 3
ATKINS SILVER STEEL 617 HIGH SPEED TUNGSTEN MADE IN U.S.A.
ATKINS MS 617 SILVER STEEL SOLID HIGH SPEED MOLYBDENUM MADE IN U.S.A.
ATKINS MW 614 P SILVER STEEL WELDED EDGE HIGH SPEED MOLYBDENUM MADE IN U.S.A.
Silver Steel®
POWER HACKSAW BLADES

HIGH-SPEED TUNGSTEN—the choice for the toughest jobs, for fast, efficient cutting of high alloy materials.

SOLID MOLYBDENUM—the economical all-round blade to cut both ferrous and non-ferrous metals.

WELDED EDGE MOLYBDENUM—it's shatterproof for top production and extra life in general purpose cutting.

ATKINS TOOL STEEL FLAT STOCK

Now Available In All Standard Sizes

- Oil Hardened
- Precision Ground
- Sides Parallel and Square
- Free of Defects and Decarburization

ATKINS SAW DIVISION
BORG-WARNER CORPORATION
INDIANAPOLIS 9, INDIANA

ATKINS Silver Steel SAWS B-W

NUT MAKING MACHINERY

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

NUT SETTING EQUIPMENT

See Screw Driving and Nut Setting Equipment.

NUT TAPPERS

See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap

Chicago Screw Co., Bellwood, Ill.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Republic Steel Corp. (Union Drawn Steel Div.), Republic Bldg., Cleveland 1, Ohio.
Union Drawn Steel Co., Div., Republic Steel Corp., Massillon, Ohio.

NUTS, Self-locking

Grip Nut Co., 310 S. Michigan Ave., Chicago 4, Ill.

NUTS, Thumb or Wing and Cap

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only).
Republic Steel Corp., Bolt and Nut Div., Republic Bldg., Cleveland 1, Ohio.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

OIL EXTRACTORS AND CLEANERS

De Laval Separator Co., Poughkeepsie, N. Y.

OIL GROOVERS

Fischer Machine Co., 310 No. 11th St., Philadelphia, Pa.

OIL SEALS

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

OILERS AND LUBRICATORS

Madison-Kipp Corp., Madison, Wis.
Norgren, C. A., Co., Inc., 3419 S. Elati St., Englewood, Colo.

OILS, Cutting

See Cutting and Grinding Fluids.

OILS, Lublicating

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F. 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

OILS, Quenching and Tempering

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F. 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 600 5th Ave., New York.

(*Continued on page* 362)

For more information on products advertised, use Inquiry Card, page 245

Lapping For Precision Flatness and Parallelity in Production Quantities

...with a LAPMASTER

This is the machine for you if you want precision flatness in production quantities at low cost. Lapmasters readily lap to the extreme close tolerance of one light band (.0000116") or less. In addition they produce an extremely fine finish to as low as 1 RMS. They are available with 12", 24", 48", 72" or 84" lapping plates.

THIS IS HOW THE LAPMASTER WORKS

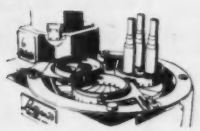
I, a heavy cast iron lap plate revolved slowly under power. **II,** large cast iron conditioning rings are held in position and rotate freely on the lap. **III,** work pieces are placed inside the conditioning ring where they also rotate on the lap. **IV,** a liquid vehicle containing fine loose abrasive flows on the lap plate and is uniformly distributed under the work pieces. At the same time the rotating conditioning rings preserve the flatness of the lap plate. These three essential features, combined with the rapid cutting action of loose abrasive produces a flatness which meets every production requirement.

1 Operator requires no previous lapping experience.

2 Lapping with loose abrasive and without excessive pressure eliminates heat and subsequent distortion.

3 Simplicity of design provides accessibility and allows ease of loading and unloading.

4 Loose abrasive distributed evenly over lapping area insured uniform results.



5 Precision laps identical parts in one cycle or parts of various shapes, heights and materials in one cycle.

6 Lap plate always kept in condition while in operation. No down time required for truing or reconditioning.

Learn more about the possibilities of production lapping and the interesting subject of measuring flatness. The illustrated fact-filled booklets are yours for the asking. Write today.

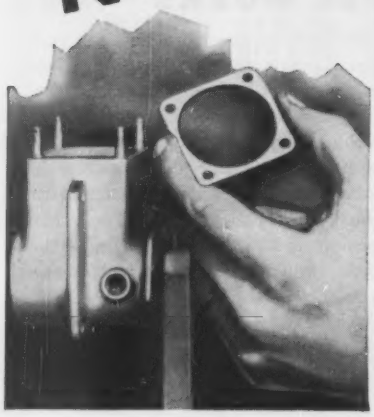
Protected by U.S. and Foreign Patents

CRANE PACKING COMPANY, Dept. M-12
1833 Cuyler Ave., Chicago 13, Ill.
In Canada: Crane Packing Company Ltd.
617 Parkdale Ave. N., Hamilton, Ont.

Lapmasters
Flatness

CRANE PACKING COMPANY 38 YEARS INDUSTRIAL PROGRESS

NEW!



LAMINATED SHIMS
of aluminum
with all laminations surface-bonded

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Crane Packing Co., 1800 Cuyler Ave., Chicago.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

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Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

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Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

PAINTING EQUIPMENT, Spray

Lowe Bros. Co., Dayton, Ohio.
Ransburg Electro-Coating Corp., 1234 Barth, Indianapolis, Ind.

PARALLELS

Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal

Mummert-Dixon Co., Hanover, Pa.

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Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

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American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

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Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

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Landis Machine Co., Inc., Waynesboro, Pa.

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Gray, G. A., Co., Woodburn Ave., and Penn R. R., Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

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Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
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Consolidated Mch. Tool Corp. (Incl. Plate, Rotary and Crank Types), Rochester, N. Y.
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Gray, G. A. Co., Woodburn Ave., and Penn R. R., Evanston, Cincinnati, Ohio.
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Consolidated Mch. Tool Corp., Rochester, N. Y.
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PLATES, Surface

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Challenge Machinery Co., Grand Haven, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Div., West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
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U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.

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Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
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Ingersoll-Rand Co., Phillipsburg, N. J.
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Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Norgren, C. A., Co., Inc., 3419 S. Elati St., Englewood, Colo.
Onsrud Machine Works Inc., 3940 Palmer St., Chicago, Ill.

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Black & Decker Mfg. Co., Penna. Ave., Towson, Md.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Millers Falls Co., Greenfield, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

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POLISHING TOOLS, Portable

Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POWER UNITS, Hydraulic

See Hydraulic Power Units or Tool Heads.

PRESSES, Arbor

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.
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Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Extrusion

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Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., Div., Oliver Corp., 142 North Duke St., York, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Foot

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Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

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Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
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Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
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Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg., Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Morgan Engrg. Co., Alliance, Ohio.
National Mchry. Co., Greenfield and Stanton Sts. Tiffin, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
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Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit, Mich.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
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Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
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Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
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Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Sheet Metal Working

Allen, Alva F., Box 426, Clinton, Mo. (Bench)
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Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Farquhar, A. B., Div., Oliver Corp., 142 North Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
L & J Press Corp., Elkhart, Ind.
Minster Machine Co., Minster, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Sales Service Mch. Tool Co., 2363 University Ave., St. Paul, Minn.
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(*Continued on page 366*)

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- Tolerances on Conditions of Position
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- Summary
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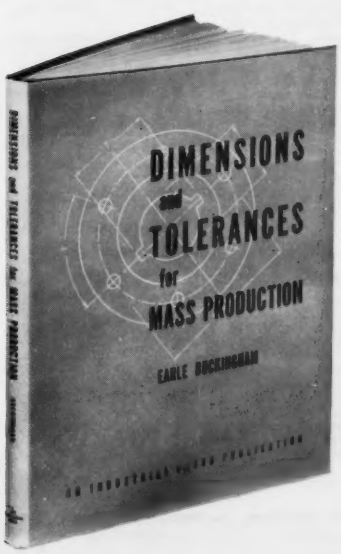

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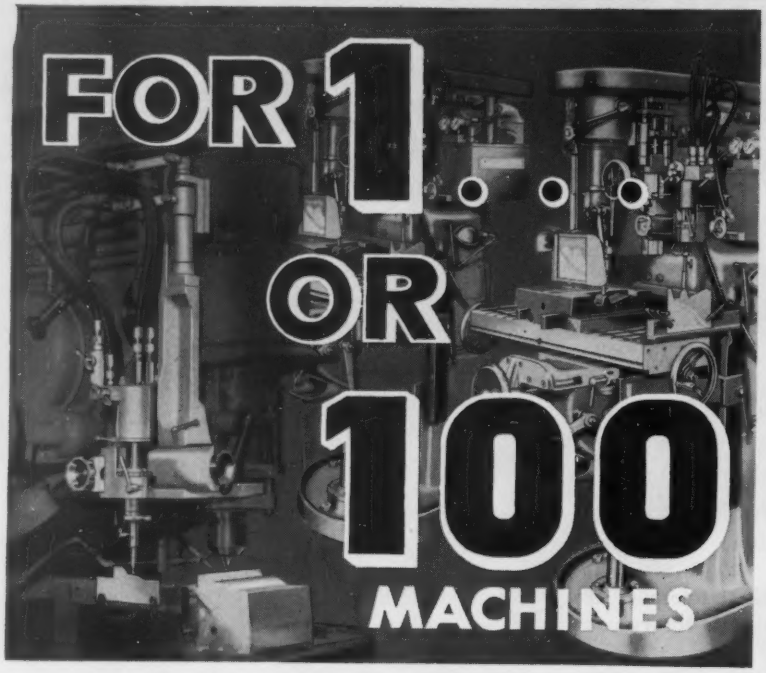

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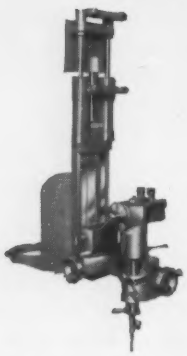

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(*Continued on page* 368)

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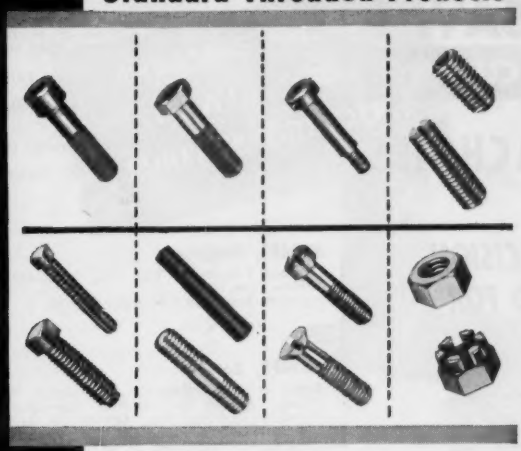

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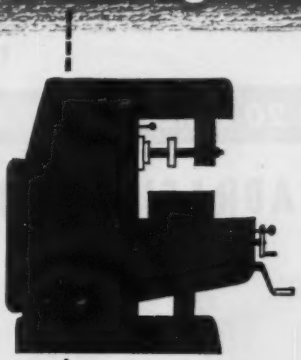

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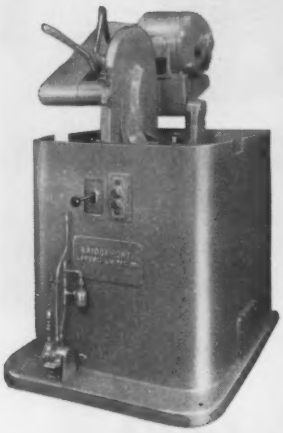
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

THE BRIDGEPORT "ABRASAW"

12 TO 20 TIMES FASTER THAN SAW CUTTING

ABRASIVE CUT-OFF MACHINES



MODEL 49-W Heavy duty, 3½" Solids, 5" Tubing or Light Sections . . . Chop Stroke, 18" Dia. Wheel.

HEAVY WEIGHT, PRECISION-MACHINED, DESIGNED FOR LONG, TROUBLE-FREE SERVICE

THESE MONEY-SAVING FEATURES ARE YOURS WHEN YOU SPECIFY BRIDGEPORT:

- Clean, close cuts of ferrous and non-ferrous metals of all kinds, as well as almost any other industrial material, including plastics, glass, ceramics, brick, brake linings, etc.
- The BRIDGEPORT "ABRASAW" cuts $\frac{5}{8}$" round cold rolled steel in 1 second; 1" square tool steel in 3 seconds; $2\frac{1}{4}$" O.D. x $1\frac{13}{16}$" I.D. SAE 1030 tubing in 7 seconds; etc.
- Chop stroke or reciprocating head
- Hand or power operation
- Wet or dry cutting
- Treadle or air operated vise
- Straight or angle cutting
- With or without vise
- Built-in Coolant System
- Surplus power in all models
- Meets strictest of safety requirements
- Write, today, for the new "ABRASAW" Bulletin

LOBDELL UNITED COMPANY

1836 WILMINGTON 99, DELAWARE 1954

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Gerotor May Corp., Oliver St. and Maryland Ave., Baltimore, Md.
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Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Pioneer Pump Div., Detroit Harvester Co., 14300 Tireman Ave., Detroit 28, Mich.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PUMPS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

PUMPS, Rotary

Brown & Sharpe Mfg. Co., Providence, R. I.
Pioneer Pump Div., Detroit Harvester Co., 14300 Tireman Ave., Detroit 28, Mich.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Tuthill Pump Co., 939 E. 95th St., Chicago 19, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUNCHES AND DIES

See Dies, Sheet Metal, Etc.

PUNCHES, Centering

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

PUNCHING MACHINERY

Allen, Alva F., Box 426, Clinton, Mo.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Joseph T., & Son Inc., 2558 W. 16th St., Chicago 18, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

RACKS, Gear Cut

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Massachusetts Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

REAMER HOLDERS

Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.

(*Continued on page 370*)

For more information on products advertised, use Inquiry Card, page 245

CAREFUL . . . GRINDER AT WORK!

Good machines are the surest step toward quality output . . . and there's no machine tool that's more careful with your work than the ABRASIVE 3B Surface Grinder.

Thousands of Abrasive 3B Surface Grinders are in use in automotive, airplane engine, and tool plants throughout this country and abroad. Find out for yourself how this fast, accurate surface grinder—with its power table traverse and cross feeds—can help in your plant. Write for descriptive catalog. Abrasive Machine Tool Company, 12 Dunellen Road, East Providence 14, R. I.

ABRASIVE
ACCURACY BOOSTS PRODUCTION

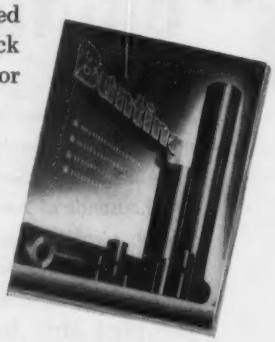
Abrasive Quality is Reflected in the Finish of Your Product

The responsibility you want?

THE has it!

IT SAVES MONEY, time and trouble when you buy materials and component parts from a trustworthy source. Your industrial supplier who sells you Bunting Bronze Bearings and Bars carries in stock countless other products of comparable high quality.

YOUR BUNTING distributor is the leading industrial distributor, or a stock-carrying specialist in certain industrial items. With money-saving convenience, he can supply hundreds of different sizes of completely machined and finished Bunting Standard Stock Industrial Bearings, Electric Motor Bearings and Precision Bronze Bars.



Ask him for a Bunting Catalog which gives complete dimensional and technical data.

Bunting®

BRONZE BEARINGS • BUSHINGS • PRECISION BRONZE BARS

The Bunting Brass & Bronze Company • Toledo 1, Ohio
Branches in Principal Cities • Distributors Everywhere

McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Warner & Swasey Co., 8701 Carnegie Ave., Cleveland 3, Ohio.

REAMERS

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 1440 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

REAMERS, Adjustable

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 1440 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMERS, Taper Pin

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kaufman Manufacturing Co., Manitowoc, Wis.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMING MACHINES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Kaufman Manufacturing Co., Manitowac, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

(*Continued on page* 372)

For more information on products advertised, use Inquiry Card, page 245

RECORDING INSTRUMENTS for Counting
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

REELS, Stock, Standard and Automatic
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORS, Heat-Treating Furnace
Norton Co., 1 New Bond St., Worcester 6, Mass.

REGULATORS, Temperature
General Electric Co., Schenectady, N. Y.

REMOVERS, Japan, Enamel, Etc.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

RETAINING RINGS FOR BEARINGS, Etc.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Waldes-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

RHEOSTATS
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

RIVET SETS
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio

RIVETERS, Hydraulic
Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Morgan Engrg. Co., Alliance, Ohio.

RIVETERS, Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Wood & Co., R. D., Public Ledger Bldg., Philadelphia, Pa.

RIVETING MACHINES
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Tomkins-Johnson Co., Jackson, Mich.

RIVET MAKING MACHINES
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

RUBBER PRODUCTS
Garlock Packing Co., Palmyra, N. Y.

RULES, Steel
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

(*Continued on page* 372)

New . . .

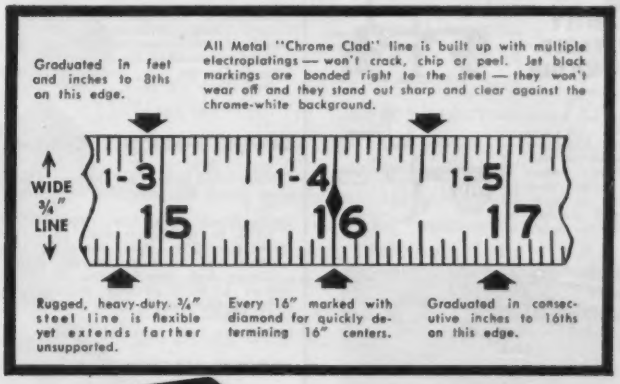
a heavy duty tape rule with a wide 3/4" line in CHROME CLAD . . .

It's the Finest Ever Made!

LUFKIN CHROME CLAD Super MEZURALL

IN 10 FT. (C9310) AND 12 FT. (C9312) LENGTHS

For extra-heavy industrial use, the new Lufkin Chrome Clad Super Mezurall can't be equalled by any other tape rule. It's packed with design and construction features that make it a super value.


Graduated in feet and inches to 8ths on this edge.
All Metal "Chrome Clad" line is built up with multiple electroplatings — won't crack, chip or peel. Jet black markings are bonded right to the steel — they won't wear off and they stand out sharp and clear against the chrome-white background.
WIDE 3/4" LINE
1-3
1-4
1-5
15
16
17
Rugged, heavy-duty 3/4" steel line is flexible yet extends farther unsupported.
Every 16" marked with diamond for quickly determining 16" centers.
Graduated in consecutive inches to 16ths on this edge.

EXTRA-LONG SELF-ADJUSTING END HOOK permits accurate hook-over or butt-end measurements.

SUPER MEZURALL ALSO AVAILABLE WITH "WHITE CLAD" BLADE

MAGIC METAL CASE

New alloy metal makes this the lightest, yet toughest and strongest die-cast case made.

PACKED IN FREE "SEE THRU" RE-USABLE BOX

Each Chrome Clad tape rule comes in a beautiful 2-color plastic box with hinged cover and snap fastener.

BUY LUFKIN TAPES • RULES • PRECISION TOOLS FROM YOUR DISTRIBUTOR

337

THE LUFKIN RULE CO., SAGINAW, MICH.
132-138 LAFAYETTE ST., NEW YORK CITY • BARRIE, ONT.

GET ABSOLUTE

Tolerance Hole Depth Control WITH

WOHLNIP

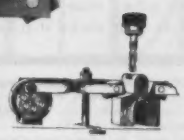
Non-Rotating DRILL STOPS

Will not mar, mark or damage the face of the work, fixture or bushing, yet give POSITIVE CONTROL OF HOLE DEPTH. Completely automatic, the WOHLNIP Drill Stop reduces human errors, simplifies difficult jobs, lowers machining cost, increases production, and eliminates rejects. Used for drilling, center drilling, countersinking, boring, milling, routing, reaming. Available with straight or taper shank, for any size drill or tool.

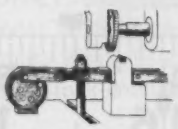
(Patent Pending)

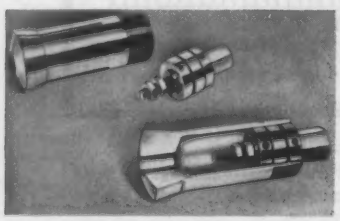
INSTANTLY ADJUSTABLE WORK HOLDER

(Patented)



The ultimate — ending costly setups and production delays. Down time becomes production time. This clamp will outperform any other Work Holder Clamp in simplicity, usefulness and cost. Adjustable to any height to suit.





COLLET STOPS

(Patent Pending)

Used with collets for second operation work. Assuring consistent accuracy, permanent setup, producing identical results. No alterations to your collets are necessary. Fully adjustable. Available for any size collets. END GUESS WORK AND REJECTS—

EXCLUSIVE DISTRIBUTORS WANTED

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390 Hillside Avenue

Hillside, New Jersey

RUST PREVENTIVES

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAND BLAST EQUIPMENT

See Blast Cleaning Equipment

SANDERS

Black & Decker Mfg. Co., E. Penna Ave., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Millers Falls Co., Greenfield, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

SAW BLADES, Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Atkins Saw Div., Borg-Warner Corp., 402 S. Illinois St., Indianapolis 9, Ind.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.

SAW SHARPENING MACHINES

Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Circular

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.

SAWING MACHINES, Friction

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SAWING MACHINES, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Grob, Inc., Grafton, Wis.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg Mass.
Walker-Turner Div., Kearney & Trecker Corp., South Ave., Plainfield, N. J.

SAWING MACHINES, Power Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Ryerson, Joseph T., & Son Inc., 2558 W. 16th St., Chicago 18, Ill.

SAWS, Circular Metal Cutting

Atkins Saw Div., Borg-Warner Corp., 402 S. Illinois St., Indianapolis 9, Ind.
Brown & Sharpe Mfg. Co., Providence, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros., & Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Atkins Saw Div., Borg-Warner Corp., 402 S. Illinois St., Indianapolis 9, Ind.
Delta Power Tool Div., Rockwell Mfg. Co. 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Portable Electric

Black & Decker Mfg. Co., Penna. Ave., Towson, Md.
Millers Falls Co., Greenfield, Mass.

SAWS, Screw Slotting

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

SCRAPERS, Hand and Power

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.

SCREW DRIVERS, Power

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.

SCREW DRIVING AND NUT SETTING EQUIPMENT

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.

SCREW MACHINE TOOLS AND EQUIPMENT

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.

For more information on products advertised, use Inquiry Card, page 245

Brown & Sharpe Mfg. Co., Providence, R. I.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Millers Falls Co., Greenfield, Mass.
National Acme Co., 170 E. 131st St., Cleveland.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINE WORK

Eastern Mch. Screw Corp., New Haven, Conn.
Mueller Brass Co., Port Huron 35, Mich.
National Acme Co., 170 E. 131st St., Cleveland.
Ottemiller, W. H., Co., York, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREW MACHINES, Automatic Single and Multiple Spindle

Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wisc.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINES, Hand

See also Lathes, Turret

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW PLATES

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Threadwell Tap & Die Co. Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

SCREWS, Cap, Set, Safety Set and Machine, Etc.

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.)
Chicago Screw Co., Bellwood, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., Co., York, Pa.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.

(*Continued on page* 374)

JOHNSON

Universal

BRONZE BARS

have many uses

BEARINGS
BUSHINGS
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SCREWS, Self-tapping, Drive

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.)
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.

SCREWS, Thumb

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.)
Parker-Kalon Div., General American Transportation Corp., 200 Varrick St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SEALS AND RETAINERS, Oil or Grease

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

SECOND-HAND MACHINERY, Etc.

Eastern Machinery Co., 1006 Tennessee Ave., Cincinnati 22, Ohio.
Miles Machinery Co., Box 770, Saginaw, Mich.
Morey Machinery Co., Inc., 383 Lafayette St., New York, N. Y.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

SEPARATORS, Centrifugal

De Laval Separator Co., Poughkeepsie, N. Y.
The Sharples Corp., 2300 Westmoreland St., Philadelphia 40, Pa.

SEPARATORS, Oil or Coolant

Barnes Drill Co. (Magnetic), 814 Chestnut, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
The Sharples Corp., 2300 Westmoreland St., Philadelphia 40, Pa.

SHAFTING, Steel

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
De Laval Separator Co., Poughkeepsie, N. Y.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SHAFTS

National Forge & Ordnance Co., Irvine, Warren County, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

SHAFTS, Hollow-Bored

Bethlehem Steel Co., Bethlehem, Pa.

SHAFTS, Turned and Ground

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SHAPER-PLANERS

Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPERS

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Smith & Mills Shapers, Inc., Div. Hamilton-Thomas Corp., Hamilton, O.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

SHAPERS, Vertical

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPES, Structural

Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEARING MACHINERY

Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

SHEARS, Alligator

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

SHEARS, Rotary

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SHEARS, Squaring

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

SHEET METALS

American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
New Jersey Zinc Co., 160 Front St., New York, N. Y.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEET METAL MACHINES, Shrinking, Stretching, Forming & Flanging.

Engineering & Research Corp., Riverdale, Md.

SHEETS, Iron and Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHIMS

Laminated Shim Co., Inc., Glenbrook, Conn.

SLEEVES

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.

SLOTTING MACHINES

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Wks. 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SPECIAL MACHINERY AND TOOLS

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Axelson Mfg. Co., P. O. Box 15335, Verona Sta., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Baker Bros., Inc., Sta. F., P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Cross Co., Detroit, Mich.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.

For more information on products advertised, use Inquiry Card, page 245

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Fischer Machine Co., 310 No. 11th St., Philadelphia, Pa.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hydraulic Press Mfg. Co., 30 Lincoln Ave., Mt. Gilead, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jahn B., Manufacturing Co., Ellis St., New Britain, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Michigan Tool Co., 7171 E. McNicholas Rd., Detroit 12, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morgan Engrg. Co., Alliance, Ohio.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Waltham Machine Works, Newton St., Waltham, Mass.
Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio.

SPEED REDUCERS

Boston Gear Work, 320 Main St., North Quincy 71, Mass.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears, Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Perkins Machine & Gear Co., West Springfield, Mass.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

SPINDLES, Grinding

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Pope Mchry. Corp., Haverhill, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

SPINNING LATHES

See Chucking Machines.

SPROCKET CHAINS

Boston Gear Work, 3200 Main St., North Quincy 71, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

SPROCKETS

Boston Gear Work, 3200 Main St., North Quincy 71, Mass.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

STAMPINGS, Sheet Metal

Laminated Shim Co., Inc., Glenbrook, Conn.
Republic Steel Corp., Niles Steel Products Div., Republic Bldg., Cleveland 1, Ohio.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethelem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 Ave., Pittsburgh, Pa.
U. S. Steel Supply Div., U. S. Steel Co., 208 S. LaSalle St., Chicago 4, Ill.
Wheeler-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Cold Drawn

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Crucible Steel Co. of America, Oliver Bldg. Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., Massillon, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co., Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, High Speed Tool

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

(*Continued on page 376*)

Buck
AJUST-TRU
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CHUCKS

Only universal scroll chuck with .0005" precision—for lathes, grinders, dividing heads, screw machines.

3-jaw and 6-jaw in 4", 5", 6", 7½", 9" sizes. 2-jaw Aviation chucks, for odd-shaped parts, in 6", 7½", 9" sizes.

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Buck Ajust-Tru 7½" chuck turns bar stock and shafts to consistent precision at The Set Screw & Mfg. Co., Bartlett, Illinois.

Shop superintendents everywhere report their satisfaction with the way these universal scroll chucks cut machinists' time, line up *dead true* in *one* minute, hold to within .0005" re-chucking precision on duplicate parts. Some report cost savings of up to 50% per operation. The Buck chuck ends most needs for stub arbors, mandrels, special fixtures . . . adapts to lathes, screw machines, grinders, dividing heads.

Make your next chuck a Buck. It will save money every time you use it. Send for latest catalog.

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Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Machine

Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Stainless

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Strip and Sheet

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

STEEL, Tool and Die

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.

STEEL, Zinc, Tin and Copper Coated Strip

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

STEEL ALLOYS

See Alloys, Steel

STEEL BARS

See Bars, Steel

STEEL STOCK GROUND FLAT

Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.

STELLITE

Haynes Stellite Div., Union Carbide & Carbon Corp. (Alloy), 30 E. 42nd St., New York, N. Y.

STOCK STOPS

Wohlnip Engineering Co., 390 Hillside Ave., Hillside, N. J.

STOCKS, Die

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. of Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Threadwell Tap & Die Co., Greenfield, Mass.

STONES, Oil or Sharpening

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.

STOOLS

Standard Pressed Steel Co., Jenkintown, Pa.

STRAIGHTEDGES

Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

STRAIGHTENERS, Flat Stock and Wire

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

STRAIGHTENING MACHINERY

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Springfield Mch. Tool Co., Springfield, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

STUD SETTERS

Errington Mechanical Laboratory Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.

SUB-PRESSES

Waltham Machine Works, Newton St., Waltham, Mass.

SUPERFINISHING MACHINES

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES

See Plates, Surface

SWAGING MACHINES

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Torrington Co., Torrington, Conn.

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Mass Gear can also produce any type of serrated or special form rod that can be generated.

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Mass Gear products are made to A.G.M.A. standards, thus insuring uniform quality.

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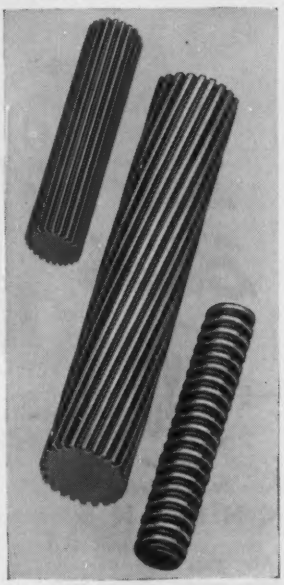

Massachusetts Gear & Tool Co.
WOBURN, MASS.

For more information on products advertised, use Inquiry Card, page 245

SWITCHES
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

TACHOMETERS
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

TANGS, Replaceable, Drill & Reamer
Nu-Tangs Inc., 1335 Bates St., Cincinnati, Ohio.

TAPER PINS, Standard
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.)
Chicago Screw Co., Bellwood, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.
Pratt & Whitney, West Hartford 1, Conn.

TAP HOLDERS
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Tapmatic Corp., 845 W. 16th St., Costa Mesa, Cal.

TAPPING ATTACHMENTS AND DEVICES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

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Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
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Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K. Machinery Co., 6402 Westfield, Blvd., Indianapolis 5, Ind.
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(*Continued on page 378*)

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Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
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Taft-Pierce Mfg., Co., Woonsocket, R. I.

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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
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Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
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THREAD GRINDING MACHINES

See Grinding Machines, Thread

THREAD MILLING MACHINES

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Pratt & Whitney, West Hartford 1, Conn.
Waltham Machine Works, Newton St., Waltham, Mass.

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Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
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Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)
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Metal Carbides Corp., Youngstown, Ohio.
Newcomer Products, Latrobe, Pa.
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Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
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(*Continued on page* 380)

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Ross Operating Valve Co., 120 E. Golden Gate, Detroit, Mich.

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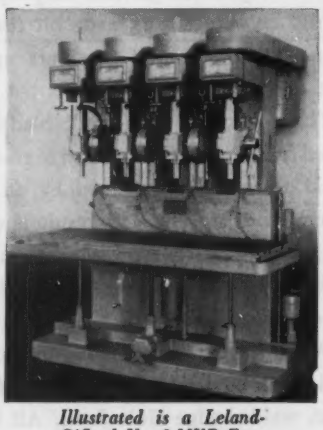

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Bethlehem Steel Co., Bethlehem, Pa.
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U. S. Steel Corp., (American Steel & Wire Co. Div., Columbia Steel Co. Div., Tennessee Coal Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Keller Tool Co., Grand Haven, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.

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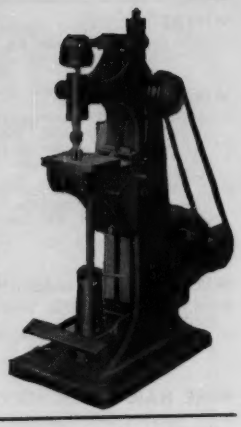

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New Heavy Duty "TAP KING" —*simplifies large hole tapping*

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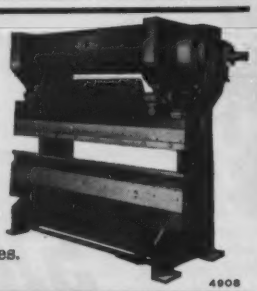

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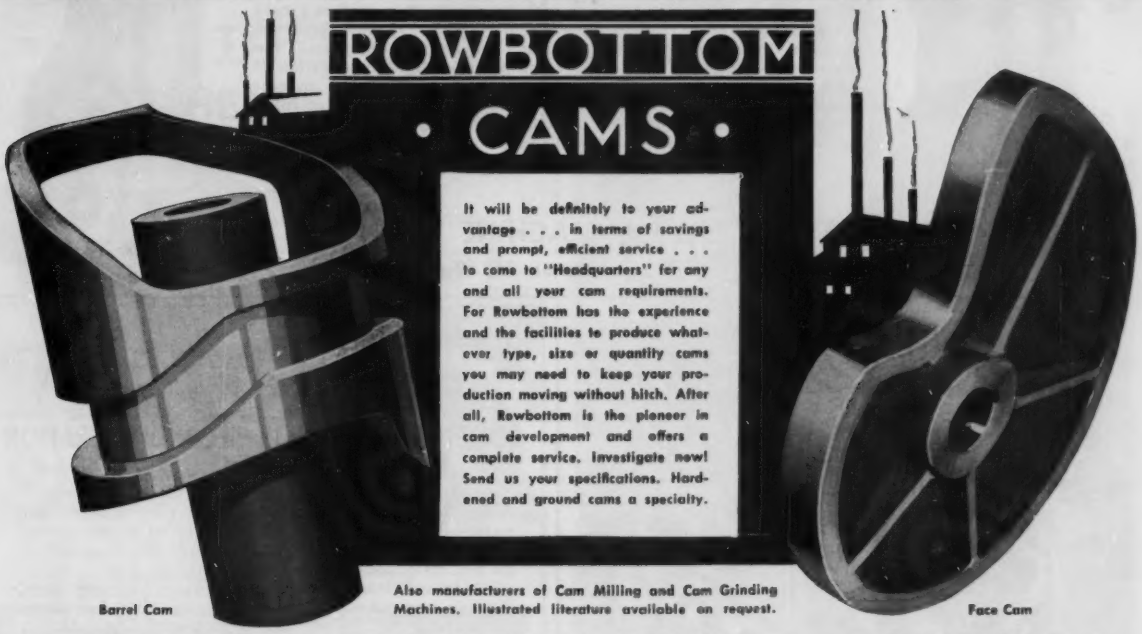

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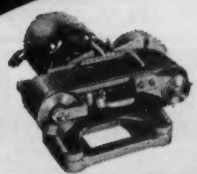

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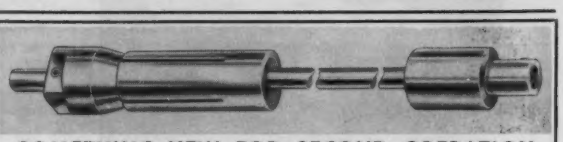

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Specially Designed

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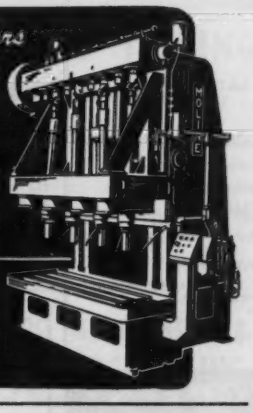

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C13 Natco
924 Barnes

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Fellows Gear Shapers

DISC GRINDERS
14A, 120A, 124 Gardner

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10x18, 10x36, 10x48, 14x48" Cincinnati
16" raised to 26x72" Norton, latest

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16, 24 Bryants

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13x54" LeBlond, Timken
15x54" LeBlond, Timken
16x30" Monarch
16x72" American
16x84" Pratt & Whitney
21"x72" LeBlond, Timken
20"x72" Sidney, Timken
20"x72" Springfield, Timken
27"x24' bed American with 12" hole, Timken
30"x40" Betts Bridgeford (2), Timken
36"x84" American, Timken
42"x180" American, new 1945

UNIVERSAL MILLING MACHINES
3A Brown & Sharpe, Timken
3B Milwaukee

PLAIN MILLING MACHINES
1B Milwaukee
4 Cincinnati Dial Type, Timken

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30"x30"x8' Cincinnati
30"x30"x10' Cincinnati
36"x36"x12' Betts, late
42"x42"x14' Niles-Bement-Pond
48"x48"x28', 30' Cincinnati
72"x72"x36' Cincinnati

SHAPERS
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32" Cincinnati
32", 36" Ohio Dreadnaught

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2F, 3F, 4FU Foster
No. 5 Gisholt, latest
4H12 Libby, late

SHEET METAL
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8' x ⅛" Dreis & Krump Leaf Brake, latest

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GRINDERS, CYLINDRICAL, 10" x 18" Cincinnati ER plain hyd., 1946.
GRINDERS, CYLINDRICAL, 16" x 72" Norton C, swing 26", new 1945.
GRINDERS, CYLINDRICAL, 16" x 96" Landis type B, 48" gap, new 1941.
GRINDERS, SURFACE, 14" x 36" Pratt & Whitney vert. spdl., 1942.
GRINDERS, SURFACE, 43" No. 16A2 Blanchard rotary, new 1947.
GRINDERS, SURFACE, 72" No. 72 Hanchett rotary, new 1946.
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LATHES, ENGINE, 16"/28" x 5' bed Smith Dram, gap, new 1945.
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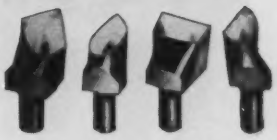

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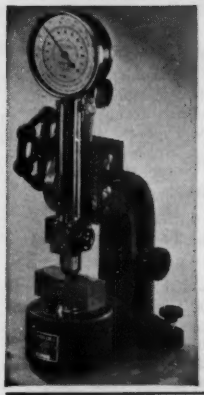

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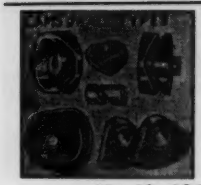

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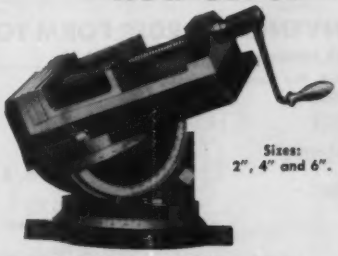

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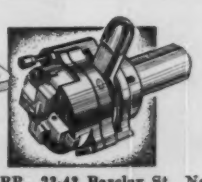

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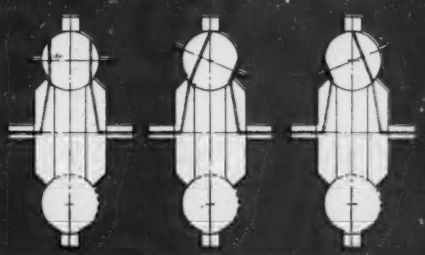

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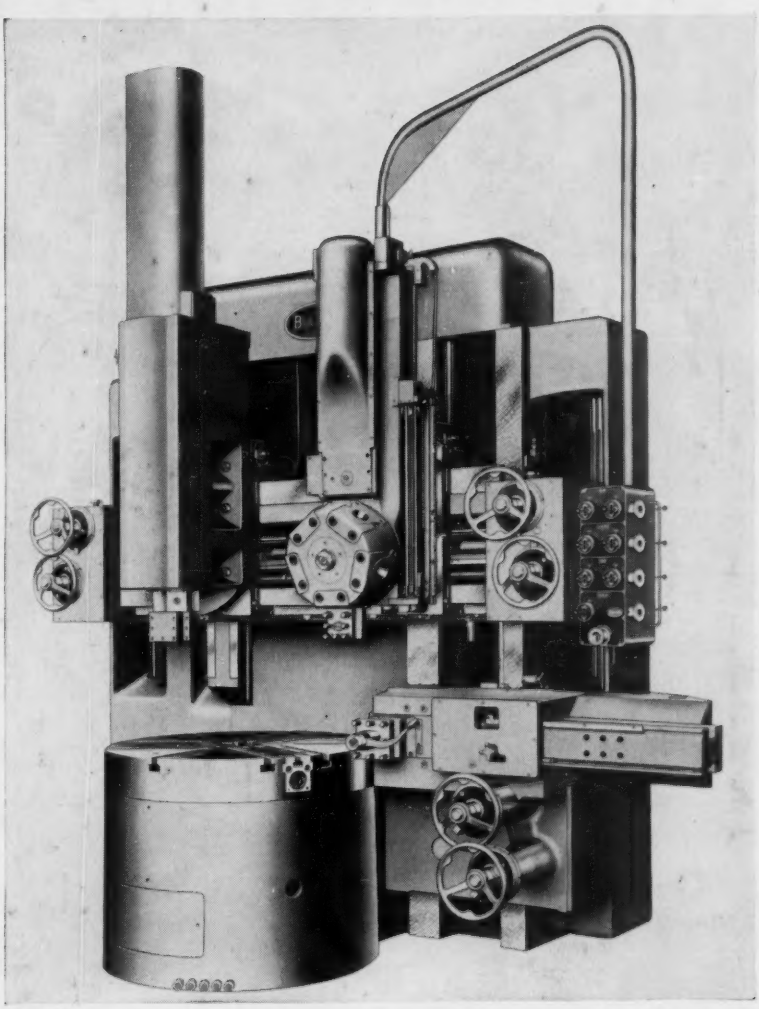

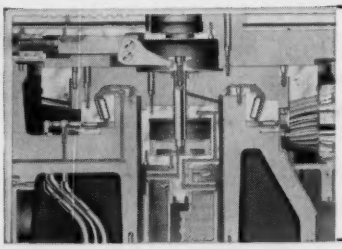

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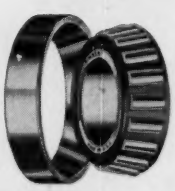

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